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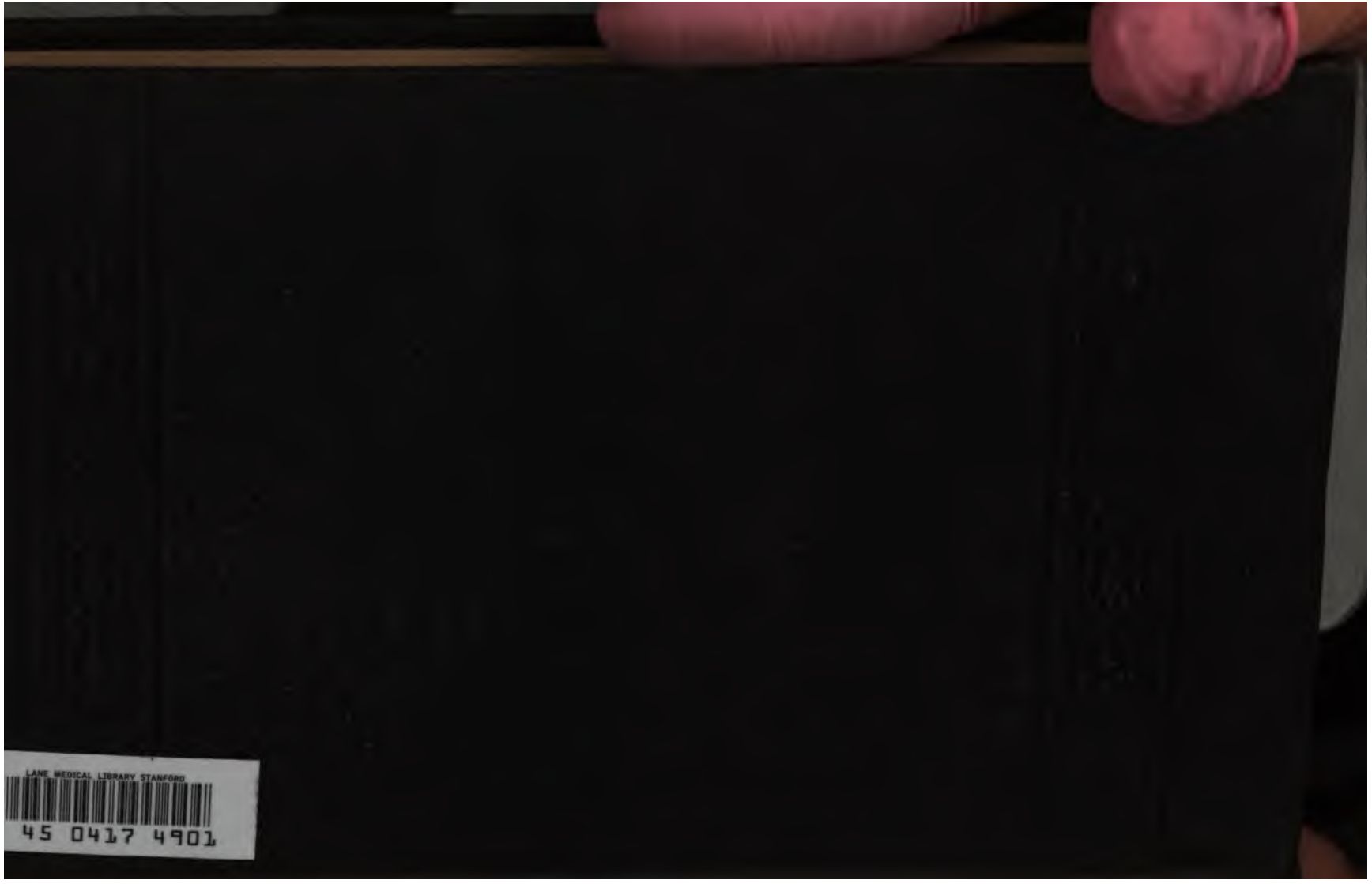
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TENTH ANNUAL REPORT

OF THE

STATE BOARD OF HEALTH

OF THE
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FOR THE

YEAR ENDING OCTOBER 31, 1891.

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STATE OF NEW HAMPSHIRE.

OFFICE OF THE STATE BOARD OF HEALTH,
STATE HOUSE, November 1, 1891.

To His Excellency the Governor and the Honorable Council:

In conformity with the laws of the State of New Hampshire, I have the honor to present herewith the Tenth Annual Report of the State Board of Health, for the fiscal year ending October 31, 1891.

Respectfully submitted,

Irving A. Watson

Secretary.

28759

MEMBERS OF THE BOARD.

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IRVING A. WATSON, M. D., *Secretary* .	Concord.

GENERAL REPORT.

The tenth annual report of the State Board of Health is herewith presented. Its object, like that of its predecessors, is more to educate the public in hygienic and sanitary matters than to chronicle the special or particular work accomplished by this department, although enough of the latter is presented to give a general idea of what the Board has done during the year.

The excellent papers which this report contains cannot fail to give much valuable information to the people of the State, upon subjects vital to their continued prosperity. There is nothing that stands so relentlessly between man and the fruition of his hopes as sickness; nothing that depresses and discourages like ill health; nothing that clouds the future with an almost impenetrable gloom like the loss of family, and nothing so wasteful to the commonwealth as the ravages of preventable diseases. It is to lessen these and other evils that this Board has labored earnestly, and with a pleasing measure of success, for a single decade. The Board was organized in 1881. The action of the Legislature in creating it was looked upon at the time by some of our most intelligent citizens as a doubtful experiment. There were not a few, however, who believed a State Board of Health could become a branch of the public service second to none other in its ability to benefit the people of the State. It would savor of egotism to express an opinion as to how far this belief has been demonstrated. The record is to be found in part in the published reports of the Board, but to a greater extent in the sanitary advancement made during that period throughout the State. The more advanced and intelligent views held respecting the

prevention and restriction of contagious and infectious diseases; a comprehensive knowledge of the effect of unsanitary conditions upon health; the great danger arising from polluted water supplies, and insufficient drainage; a more general belief in the responsibility of environment for many of the diseases which afflict mankind, and many other once doubted facts, indicate that the people of the State are becoming educated in matters pertaining to health. The evidence of this is patent in nearly all our towns and cities. Improved systems of sewerage, increased water supplies, more complete isolation in contagious and infectious diseases, a greater number of local boards of health with a more thorough comprehension of their duties, are among the obvious evidences of an increasing knowledge of the means necessary to secure and maintain good health.

In less than a single generation the theory of sanitary science has become grounded in a mass of incontrovertible facts so apparent as to be recognized by every intelligent person and community. Twenty-two years ago the first state board of health in this country was established; to-day there are thirty-six state boards and one territorial board of health, while thousands of local boards have been organized. Such an onward march of sanitation could never have taken place, involving as it has the expenditure of hundreds of thousands of dollars, had it not been attended, directly or indirectly, with the most remunerative results to the public, and it is only when passively or inefficiently applied that disappointment and failure follow. Isolation and disinfection positively guarantee the suppression of contagious and infectious diseases if properly applied. Failure is not, therefore, chargeable to the means, but to the imperfect application. The same is equally true in the application of sanitation and hygiene to all the conditions and surroundings of life to which they bear any relation.

While the results of sanitary work have been most marked and the progress as rapid as the most sanguine could reasonably expect, we are still a considerable distance short of what

it is possible to attain. Until our death records show a vastly reduced mortality from consumption, diphtheria, scarlet fever, typhoid fever, and other preventable diseases, there must be maintained an unceasing and untiring effort, educational and executive, to accomplish the grand and beneficent results which sanitary science has made possible.

SANITATION AT OUR SUMMER RESORTS.

The sanitary condition of our summer resorts — hotels, boarding houses, parks, and even farm houses where summer boarders are taken — is, as a whole, most excellent. There has been during the past few years an increasing appreciation of the advantages of sanitation among the class who receive summer boarders. With this class it has become identified with full houses and financial prosperity — a lesson which should with equal force be impressed upon town and municipal administrations. The summer tourist is contributing to the prosperity of the State to a degree surpassed only, if at all, by the manufacturing and agricultural interests. Indeed, it may be truthfully said that but for the summer visitor, agriculture in New Hampshire would be at a much lower ebb than it is at the present time.

The average tourist has a wholesome fear of unsanitary conditions and unhygienic surroundings, and our State would not be the resort of the thousands who annually visit it if sanitation were not carefully and duly considered by those who entertain them at hotels and country homes. Large sums of money are annually expended to maintain and improve the sanitary conditions of our hotels, boarding and farm houses, for the special purpose of providing every essential to the comfort and good health of the visitor. This work is so effectively done that an outbreak of any disease traceable to defective drainage, polluted water or the like is remarkably rare among the tens of thousands that sojourn with us during the summer and autumn months. We have always maintained that the State should protect to its utmost ability the health of the summer visitor, and to that end we

have constantly sought to secure the most healthful environments at all places to which he is invited. The results have been of the most gratifying character. Many of those who have money invested at summer resorts fear an outbreak of any disease of a zymotic nature more than they do a fire, for such an occurrence means an injury to their business from which it would take a long time to recover; hence good sanitation, with constant watchfulness to maintain it, is their only insurance against loss from disease. To this fact may be attributed very largely the excellent sanitary conditions that characterize most of our summer resort hotels. Of course it is not to be asserted that there are no exceptions to this general statement, but it is a matter of state congratulation that they are so few.

With our grand mountains, the charming valleys, the beautiful lakes and streams, the invigorating atmosphere, delightful hotels and attractive farm houses, and good sanitation, we can welcome the constantly increasing thousands to our State with every reasonable assurance that the chief objects for which they come — health, recreation, and happiness — will be secured.

LOCAL BOARDS OF HEALTH.

Legally, every town in the State has a board of health or a health officer, by virtue of the law that makes the board of selectmen a board of health if none other is elected or appointed; but as an actual fact, many of the smaller towns have no active board. In only a very few towns do the selectmen make efficient health officers. They are elected wholly for the purpose of administering the business and financial affairs of the town, without regard to any qualifications as health officers, and they not infrequently know little or nothing of the duties pertaining to the latter office. This is not as it should be. There is no town in the State, however small, that may not be benefited by the wise and intelligent work, instructions, and recommendations of a well qualified health officer or board of health. The law provides

that the selectmen may appoint health officers when none are elected, but that they shall appoint if so petitioned by ten legal voters. In some towns the selectmen, recognizing the importance of the office, appoint without delay; in others a petition has been necessary to secure the appointment; while in a larger number of instances no action whatever is taken. However, there are a good number of local boards of health in the State doing valuable and efficient work for their respective towns, and among this number are a few boards of selectmen than whom no better health officers could be found. Nevertheless, the average board of selectmen does not make a competent board of health, and we would recommend that the law be so changed as to require in the smaller towns the appointment of a well qualified person to act as health officer, and a board of health in the larger towns. We believe such action would improve the public health service of the State.

The aggregate amount of work accomplished by local health officers throughout the State is very great, and is of incomparable benefit to the commonwealth. The progress in this direction from year to year is one of the tangible proofs of an increasing public recognition of the value of sanitation to public and private interests.

WATER SUPPLIES.

Until within a comparatively recent period a public water supply, from an ample source, distributed by means of pipes, and for which a reasonable annual charge should be made, was thought to be impracticable and unprofitable, except in the cities. Even the larger towns, like Rochester (now a city), Laconia, Lebanon, Littleton, Claremont, Lisbon, and others, until recently had no system of water-works that could be called a public supply. These towns, as well as nearly every village in the State, depended almost wholly upon wells for water for domestic uses. Ten years ago this Board commenced the work of pointing out to the public the manifest dangers lurking in the wells of a settled community, or

in any locality where soil pollution exists, and the work has been continued to the present time. Diseases due to contaminated water have been repeatedly shown up in our annual reports. The analysis of the water in hundreds of wells in the State have proven the truth of the doctrine taught, until the public mind has become thoroughly convinced upon this exceedingly important subject. As a result of a more general and wide-spread knowledge of the dangers arising from the use of contaminated well waters, there has come to be a demand for water for domestic purposes from sources free from the dangers alluded to; hence a great many of our villages are now supplied with good water at a reasonable and moderate cost to the taker. The list of the towns thus supplied is a long one and is increasing yearly. At each session of the Legislature charters for new water-works are granted. The direct result of a better water supply has been manifested in every place that has been fortunate enough to secure this great public improvement.

SEWERS.

Not less important than an ample supply of pure water is a good system of sewers for every village and city. A polluted and sewage-soaked soil is as dangerous a condition as can surround a home. This fact is well recognized, at least by the more intelligent citizen, and each year witnesses many improvements in this direction. Many of our towns and cities have expended during the year no insignificant amount of money in the extension of sewer systems already commenced or in the construction of new ones. Among the latter, and also the most notable, is that of Laconia. This enterprising and growing town recently constructed a splendid system of water-works, and the need of a complete system of sewers immediately became most urgent. At the last town meeting an ample appropriation was voted for the purpose, and the system is now nearly completed. This work will be of incalculable benefit to the town. Nashua, Manchester, Concord, Dover, and Claremont are among the

places that have expended considerable money in extending their sewers. Many of the smaller towns have built sewers in their more thickly settled portions, and will extend them as rapidly as the demand and a prudent expenditure of the public money will warrant.

The progress made in this direction is very gratifying, and is another indication that the people are awake to the fact, that it is cheaper to evade some of the dangers that accompany the aggregation of communities than to be subjected to the disastrous results that often follow their neglect.

PUBLIC ALMSHOUSES.

The several county almshouses are inspected by the Board every few months, and such suggestions as are deemed advisable made to the administrative authorities. It is gratifying to be able to state that since the inauguration of these inspections there has been a great improvement in these institutions. The county almshouses afford a home for some twelve hundred unfortunates, better than many of them ever had before. They are compelled to endure no hardships, have plenty of good food, good beds, in fact, enjoy the comforts of life to a degree before unknown to some of them at least. Of course there are some of the inmates who have seen better days, but even for them this refuge is a blessing in the time of their misfortune.

The management of these institutions is good and most of the counties take more or less pride in them. We have made frequent reports upon the general condition of the almshouses. The annual report of this Board for the year 1889 contains a detailed description of each almshouse in the State. A brief report concerning their present condition is also given elsewhere in this volume.

RAILROAD SANITATION.

The various railroads of the State are giving more attention to sanitary questions than formerly. There is now a disposition among railroad corporations to give due consider-

ation to the comfort and convenience of the traveling public, not only by means of rapid transportation, cheap rates, and elegant coaches, but by providing better stations and more attractive grounds. To this end much labor and money have been expended within a short time, and the results are noticeable all along our railroad lines, chiefly along the lines of the Boston & Maine, the Concord, and the Maine Central. As these corporations control most of the roads in our State, the improvements are consequently wide-spread. But the spirit of progress is also manifested by other roads; even the Grand Trunk, a line noted for its dirty stations and grounds, has felt the influence of the age and is making some improvements in this direction. The Boston & Maine, the Concord, and the Maine Central are progressive corporations and during a short period have greatly improved the sanitary conditions of their respective lines. This has, perhaps, been accomplished through the broad purpose of a general improvement, rather than by special effort to this particular end; but it should be stated that these railroads have expended no very inconsiderable sums solely for the purpose of bettering the sanitary condition of some of their stations. We are also advised that other extensive changes are contemplated in the near future. At some stations there is urgent need of alterations and changes, nearly all of which are known to the respective roads.

We have reason to expect that there will be no retrograde movement in the policy that has already given us marked evidences of proficiency and advancement.

VITAL STATISTICS.

The amount of hard labor and pains-taking detail connected with the collection of vital statistics is out of all proportion to the little interest taken in the work by the general public; nevertheless, the value of an accurate registration of births, marriages, and deaths, and of the statistical tables compiled during months of ceaseless industry, is incalculable to the State and an indispensable obligation which the common-

wealth owes to every citizen. These records constitute an index to the health-rate or to the death-rate of every town and city in the State, and to the thoughtful and considerate man seeking a residence for himself and family, as well as to the public-spirited citizen who desires that the health standard of his town shall be maintained at a high rate, the registration reports, or the information deduced therefrom, is a valuable guide. The mortality of a given place for a series of years, if accurately returned and recorded, becomes an infallible register of the healthfulness of the locality. If the mortality rate is low the citizen knows that his family is more safely guarded against illness than if the death-rate were higher; and if the continued death-rate is high the health authorities are admonished thereby that there is urgent work for them to do. No health department can direct its work to the greatest possible advantage without the knowledge revealed by an accurate registration of the causes of death within its jurisdiction.

A record of the births, marriages, divorces, and deaths taking place within the State shows the actual movement of the population in various directions with more exactness than can be obtained from any other source.

In addition to the information of a public nature thus secured, it frequently happens that questions of great individual importance, resting upon the record of a birth, a marriage, or a death, can be settled in no other way. As a matter of fact, the registration of vital statistics in New Hampshire commenced about ten years ago, and is yearly becoming more accurate and valuable, especially the returns of marriages and deaths. The Registration Report, compiled under the direction of the secretary of this Board, has grown to be a work of great labor and constitutes a volume nearly the size of the annual reports of this Board. It is composed chiefly of statistical matter and is designed for purposes of reference. This report may be found in the public libraries of the State and is also distributed in various other directions. If they are continued without interruption they

will become in a few years an invaluable guide to the health officer in the work of reclaiming unsanitary localities, and in preventing and restricting many of the diseases that now figure too largely among the causes of death.

REGULATING THE PRACTICE OF MEDICINE.

Many foreign countries, as well as several States in the Union, have already recognized the fact that the people should be protected against the merciless and unscrupulous impostors who travel about, advertising to cure all forms of disease or to have most miraculous powers in certain specialties. These quacks, some of them well educated and consequently more finished and adroit in their manner, offer the most attractive and alluring inducements to the afflicted, who, prompted by the hope of receiving benefit, too often become the innocent and defrauded victims of these itinerant swindlers. Their promises are delusive, and their charges, always cash down, extortionate. The sick, especially those suffering from long-standing or chronic diseases, naturally enough grasp at anything that offers any hope of recovery, hence they should be protected by law against the seductive coils of charlatanism.

In our own State the evils of medical quackery have frequently been seen. We have had for several years a law which has accomplished something, although it has been pronounced unconstitutional and on the first of January, 1892, when the Public Statutes take effect, will be repealed. Our State is now the favorite haunt of several noted, disreputable, conscienceless medical swindlers, whose lying handbills and advertisements are familiar to the public.

A bill regulating the practice of medicine was defeated at the hands of the last Legislature, because the measure was regarded as too weak and defective, especially after it had been amended by the House, to secure the desired end — the protection of the people. The subject should receive the consideration of the next Legislature and a law be enacted that will protect all while it shall injure no one.

THE CATTLE COMMISSION.

One of the most important laws enacted at the last session of the Legislature was that creating a state board of cattle commissioners. If vigorously executed it cannot fail to afford great protection to the stock owners of the State against the spread of tuberculosis and other dangerous animal diseases. The law provides that the secretary of the state board of agriculture, the master of the state grange, and the secretary of the State Board of Health shall constitute the commission. The board was organized early in the year and commenced work at once. Petitions for the inspection of herds supposed to be infected with tuberculosis have kept the board constantly at work thus far in this one direction. Up to date many herds have been examined, and about sixty animals found to be infected with the disease have been destroyed. The importance of this work can only be realized when it is remembered that tuberculosis (consumption) in the cow and in the human family are identical, and that doubtless the germ of the disease is not infrequently conveyed to persons through tuberculosis meat and milk — chiefly the latter. The State has, therefore, truly taken a step in the right direction in protecting its citizens against one of the sources of the most fatal and insideous diseases known to mankind. The law referred to will be found elsewhere in this report.

THE COMMISSION OF LUNACY.

The State Board of Health by virtue of a law enacted in 1889 is also a Board of Commissioners of Lunacy. The work which devolves upon the Board in the latter capacity is considerable and exacting, and is represented in a separate annual report. It may, however, be a matter of public interest to state that during the year one hundred and five indigent insane persons have received remedial treatment by order of the Board. Of those committed during the year for remedial treatment 13.79 per cent have recovered; 4.6 per cent much improved; and 6.9 per cent improved. These

results alone are more than sufficient to justify the enactment of the law under which these results have been accomplished.

Those wishing a more detailed statement of the work of this department are referred to the annual report of the Board of Commissioners of Lunacy.

SECRETARY'S REPORT.

COUNTY ALMSHOUSES, ASYLUMS, AND JAILS.

ROCKINGHAM COUNTY ALMSHOUSE AND JAIL.

Two important improvements are being added to this institution, to wit, a new building for the demented class of the insane, and a water tank for the purpose of securing an abundant water supply for sewerage purposes. The new building for the insane is a wooden structure 47 x 30 feet on the ground, two stories high, and containing 32 rooms. It is divided into two wards, one for males and the other for females, and is to be heated by steam. The building is designed especially for the class mentioned and is sheathed throughout. It is located directly in the rear of the building occupied by this class at the present time and about 100 feet in the rear of the main asylum, and as soon as the new building is completed the old one will be removed to a position adjoining the stables and will be used for a carriage-house. This change will prove a material improvement for a few years to come.

The water tank alluded to is located in the rear of the almshouse; it is built upon supports and has a capacity of about 10,000 gallons. It is built precisely like the modern railway tanks and its elevation is sufficient to force the water to the highest point of the roof of the almshouse, the top of the tank being about 10 feet higher than the most elevated portion of the roof. The tank will be supplied from a pond in the field by steam power, and is intended for fire and sewerage purposes solely.

The general condition of the almshouse and other buildings, so far as cleanliness and neatness are concerned, was most excellent. The rooms are kept well whitewashed and the floors and other woodwork thoroughly scrubbed. The jail, which at the time of the inspection accommodated 48 prisoners, was in a most excellent condition; it was perfectly neat and clean throughout — in fact, in this respect the institution could not be improved.

The institution contained at the time of inspection 191 inmates, 12 of whom were children under fifteen years of age. The managers are Mr. and Mrs. Charles C. Tucker.

STRAFFORD COUNTY ALMSHOUSE.

No very material changes have been made at this almshouse since our report last year. There were present at the time of the inspection 170 inmates, 25 to 30 of whom were children. The institution was in a very neat and clean condition, and the rooms were exceedingly clean and tidy. The walls are whitewashed at least once a year, this adding much to their wholesomeness.

This institution is a house of correction as well for the county, and has upon the average about a dozen prisoners. Some improvements are needed here. The men's closet in the basement should be repaired; some of the fixtures in the basement are not properly trapped, and it is said that at times the odor of the sewer is noticeable; the kitchen sinks should be trapped; and in fact, the plumbing should be carefully overhauled, and an iron sewer should replace the Akron pipe under the building.

The prisoners' cells, which are in the basement, have recently been whitewashed and were in good condition. A few improvements in the line suggested would place the institution in a satisfactory condition.

STRAFFORD COUNTY INSANE ASYLUM.

This asylum contains on an average about 40 inmates, at the time of the last inspection the exact number being 41.

There has been a very great improvement in this asylum since our last report, both in its general cleanliness and appearance, and in its management, but the building itself is far from being a model. It is a cheaply built wooden building, with poor walls and floors, the latter being so loose and defective that frequently when being washed the water drips through into the rooms below. The chief criticism made against this institution in our report for 1889 still holds good. The improvements are brought about chiefly by the use of paint. The county was fortunate, or unfortunate, in having two or three prisoners who were painters, and they were set to work painting the interior of the building. The corridors of the entire upper story had been painted, and those of the lower story were well under way. This had added greatly to the cleanliness of the place, which has never before presented so good an appearance as at present.

The asylum is cared for by Mr. and Mrs. William Driscoll. The county is to be congratulated in this improved condition. The vaults are better cared for than formerly, although the present arrangement can never be satisfactory. It may be remarked here that there is not at all times a sufficient water supply for the almshouse and jail, but the county commissioners are now considering means for increasing the supply.

Whenever this shall have been accomplished, water-closets should be substituted for the privies now in use at the asylum.

The almshouse and asylum are under the management of Mr. and Mrs. Charles E. Demeritt.

STRAFFORD COUNTY JAIL.

This jail is located at Dover, a little out of the compact part of the city, upon a healthful and pleasant elevation. This is the somewhat celebrated "revolving" jail, the only one of the kind in the State.

The buildings are of brick, well constructed, and consist of house for the jailor and the jail proper. The jail proper is divided into two parts, one containing upon the lower floor

the office and upon the upper four cells for women. These cells are stationary, being constructed the same as any ordinary cell, with grated window and door in each. It was from one of these cells, in which he was confined on account of a supposed serious illness, that a noted murderer recently escaped, and not from the revolving cells as has been supposed by some. The cells in the main part of the jail consist of V-shaped sections of a cylinder or turret twenty feet in diameter and two stories high. This cylinder is placed upon bearings so that with proper mechanism it may be revolved. There are ten cells in each story of this cylinder, twenty in all. Surrounding the cylinder and built as closely to it as possible and allow it to revolve, is a network of steel rods and plates, with one opening through the same for each story. When it is desired to admit or release a prisoner, the cylinder is revolved until the desired cell is brought in front of the door in the outer grating. When it is desired to allow the prisoners to come out of the cells into the corridor, as is done daily with possibly a few exceptions, the cylinder is slowly revolved, and as each cell comes in front of the doorway in the fixed grating, the prisoner steps out, and when the cylinder has made one revolution the prisoners may have been all released.

In each cell is a fixed water-closet, with an ample amount of running water, and the sanitary conditions are excellent. The corridor surrounding the cells is of ample dimensions and has several well grated, large windows, making the entire jail pleasant and light. There is in each cell a folding hammock cot which occupies but little space during the day. The front of each cell is open to the fixed grating, thus affording ample ventilation and light. The partitions between the cells, as well as all other parts of the cylinder, are of plate iron or steel.

In each corridor, protected by an ample screen, is a good bath-tub and sink for the use of the prisoners. There is an electrical communication between the jailor's apartments and the cells in each corridor, so that in case of sickness in the

night, or from other cause at any time, the jailor can be summoned.

The jail was neat and clean throughout and is in every respect in excellent sanitary condition. The present jailor is Mr. Frank M. Libby. The jail was built in 1888, and there were 28 prisoners confined in it at the time of the inspection, all males.

BELKNAP COUNTY ALMSHOUSE.

No especial changes or improvements have been made at this institution recently, except that two or three rooms, in the attic of an adjacent building used for a shed, soap-making, etc., have been finished off for the demented insane. These rooms are not suitable for any class of the insane except during the summer season, when they are, perhaps, admissible for demented patients like the three who were found occupying them.

At this point we may remark that the county needs a new and separate building for its chronic insane. There are at this institution some 12 or 15 insane persons, all of whom, with the exception of the three mentioned, are allowed to mingle with the other inmates of the almshouse. Among them are one or two who have recurrent mania and have to be locked up at times. This state of affairs is in a measure unsafe, and greatly disturbs the comfort of the other inmates. Such a building as the county needs might be constructed at a comparatively small cost, as a large building is not required, but it should be so situated as to admit of easy access to the patients and steam heat from the main building.

The general condition of the almshouse is very fair, although some painting is needed and the walls of many of the rooms require repapering, especially in the men's wards.

An increased water supply is demanded. At present the water is pumped by wind power from the bay near by to tanks in the attic of the almshouse. At times when there is not sufficient wind to work the pumps the institution suffers for want of water and has to be very economical in its use.

We would recommend that additional tanks be placed in the attic, or, preferably, that the institution be connected with the public water supply of Laconia.

The sanitary condition of the institution could be improved by abolishing the privy in the basement of the main house, and also those back of the building used as the shed, soap-making room, and quarters for the demented insane. These outhouses are in a very unsanitary condition, and must necessarily remain so, owing to their low situation, as long as they continue in use.

The jail is in a very good condition, except for broken and dilapidated seats and covers in several of the water-closets, and some difficulty with two of the flushing tanks. These should be repaired at once. The cells and corridors were very clean, and were in a satisfactory condition, other than the defects mentioned.

There were 60 inmates present at the time of inspection, among whom were five children. Negotiations were pending for the placing some of the children in good homes; during the present season three children have been placed in good families.

The institution is managed by Mr. and Mrs. Thomas L. Smith.

CARROLL COUNTY ALMSHOUSE.

Quite a number of improvements have been made at this institution during the year. The county delegation in 1889 instructed the county commissioners to make certain changes here, to provide two bath-tubs, one for the male and the other for the female inmates; to furnish better protection against fire, and traps for the various plumbing fixtures. All these directions have been carried out. A large tank, having a capacity of several hundred gallons, has been placed in the attic in the main wing of the almshouse. The top of this tank, which is circular in form, is covered with a substantial floor upon which is a force-pump permanently attached to about 150 feet of hose. Leading from the top of the tank is

a short stairway opening directly upon the roof of the building, and a narrow walk has been made along the ridgepole of this wing and of the main house, so that in case of fire every part of the building can be easily reached. A line of hose constantly attached to a stand pipe in each corridor, is coiled and placed in a case and is always ready for immediate use. The work seems to have been thoroughly done and affords great protection against disastrous results, but the danger from fire will not be reduced to a minimum until the numerous stoves used to heat the building are abandoned. We have before urged, and do now repeat, that there is constant danger from these stoves as they have been managed; they should be abandoned and steam heat substituted. Two new bath-rooms, each supplied with hot and cold water, have been put in. This is a long needed improvement and much appreciated by the superintendent. New sinks have also been constructed in connection with the bath-rooms.

The drainage or sewerage of the institution is better than ever before. The plumbing has been overhauled and good traps placed under all the fixtures. The sewage is discharged into a stone drain outside the building which delivers its contents in an open field sufficiently distant from the premises. The entire institution, so far as internal cleanliness is concerned, is all that could be desired — indeed, it is not an exaggeration to say that a remarkable degree of cleanliness exists throughout the entire building. This is owing to the constant oversight and excellent executive ability of the matron, Mrs. Manson. The value of whitewash is thoroughly understood, and it is applied once or twice a year wherever it can be used to advantage.

It should be remarked that the floors in some of the rooms are badly worn and need replacing, and this to be done within a very short time.

There have been improvements also in the external appearance of this institution. After the new barn was completed the old one was demolished and the fence between the new barn and the almshouse taken away. This gives more room about the buildings and is better in every way.

There are still a few matters that should be attended to, and the county will doubtless make the needed changes as rapidly as practicable. The institution was never before in as good a condition as at the present time.

CARROLL COUNTY JAIL.

In the report of this Board for the year 1889 is a description of this jail, together with some severe criticisms upon it. It was then characterized as the worst jail in the State, and although a few changes have since been made, it still ranks the lowest among our jails. It is in no sense a decent place for the detention of criminals. We discussed the condition of this building before the county delegation in 1889, representing fully its utter unfitness for occupancy, and requesting that at least a fire-escape be provided that would offer some hope of rescuing the prisoners in case of fire; that the cells, which, with a single exception, were so dark at midday that a person could not see to read, should be lighted and some means be devised for ventilating them. The delegation voted to instruct the commissioners to whitewash the cells, to place a small grated window in each, and to furnish some practical means of reaching the prisoners in case of fire. The commissioners complied by putting a window, about 8 x 10 inches, in each cell, the window opening directly against the outer wall of the building and within a few inches of it. This admits air and improves the ventilation, but does not furnish light enough to be of any service. Openings should be made in the outer wall of the jail opposite the jail windows, or some other means devised for admitting light. The fire-escape consists of an iron frame with an iron door set into the wall beneath the window on the east side of the building, and connects with one of the sheds or L's of the almshouse. The utility of this fire-escape is very doubtful. In case a fire should break out in the shed or L mentioned, the fire-escape could not be reached, and if the fire had gotten under much headway the entrance to the jail by the door might also be cut off.

The vault connected with the jail is an offensive, unsanitary affair at best. It is true that the changes made by the commissioners are an improvement over the former condition, but the jail still falls far below what the county should have. The subject of a new jail has been discussed by leading men in the county and it is very generally understood that a suitable building will be erected in the near future. The heavy debt with which this county has been burdened, accounts for the present condition of these county buildings.

At the time of the inspection there were 60 inmates at this almshouse, including two prisoners and seven children.

MERRIMACK COUNTY ALMSHOUSE AND INSANE ASYLUM.

This institution, all things considered, is the best of its kind in New Hampshire; in fact, it does the county great credit in nearly every particular. The buildings are in fine condition and nearly all of them are of comparatively recent construction. The fine brick building which constitutes the almshouse proper, was built but a few years ago. A little later the insane asylum, another large and commodious brick building, was erected. During the past year the county has built a substantial barn 132 feet long by 32 wide and 18 feet post. The few out-buildings are being placed in excellent condition, so that for several years to come the expenditure for construction is likely to be very small.

The improvements suggested by this Board from time to time have been very promptly carried out, almost without exception. During the past year some additions have been made to the equipments of the almshouse. Large sinks for washing dishes have been placed in both dining rooms. Large clothes closets have been built upon the first floor, and additional steam radiators have been placed in the men's room in the attic and in the corridors.

The sanitary condition of the building is good; there is an abundance of water for flushing the sewers and for all other purposes; the institution is in a cleanly condition, the walls

are frequently whitewashed or painted, and every effort is made to maintain the best condition possible in an almshouse.

The insane asylum, by far the best owned by any county in the State, has also been further improved during the year. Registers for hot air have been put into several rooms, experience having shown that the registers in the halls did not sufficiently warm some of the rooms.

This entire institution is managed by Mr. and Mrs. William Tasker, and there were 138 inmates, among them 14 children.

MERRIMACK COUNTY JAIL.

At the time our 1889 report was made, Merrimack county jail was in a very unsanitary condition, as will be seen by a letter written to the county commissioners at that time:

Board of County Commissioners, Merrimack County, New Hampshire:

GENTLEMEN, — Your attention is respectfully called to the unsanitary condition of Merrimack county jail. The water supply and ventilation are inadequate, the plumbing is in a very faulty condition, and the drainage is not equal to the demands necessary to maintain a healthful condition.

In each cell there is a dirty, dilapidated, cast-iron bowl, originally porcelained, with an insufficient water supply for flushing. These closets are wholly without ventilation, or practically so — an opening in the wall 2 x 2 x 8 inches, just the size of an ordinary brick, amounts to nothing as a means of ventilation. The twelve cells are practically alike in this respect, the sanitary condition of each being exceedingly bad.

There is an opening in the floor of the corridor to allow the wash-water to flow off the brick or concrete floor, and it is directly connected with the sewer without any intervening trap. The sewer leads directly to a cesspool, a few rods distant from the buildings, the odors from which were distinctly noticeable in the corridor.

We would respectfully recommend that new closets, with proper ventilating flues, be constructed for the cells, and that traps be put in wherever necessary.

In the jailor's apartments the bath-tub and wash-bowl are without traps, and proper traps should be supplied for these fixtures. The

small trap under the kitchen sink should be removed, and a trap that cannot be siphoned substituted therefor.

At the time of the inspection the water supply was found to be insufficient for the demands of the jail. Either the tank capacity should be increased, or a pipe large enough to insure an ample supply at all times of the year should be laid to the street main.

In the basement of the jail is a large opening connected with the sewer; this should either be trapped or discarded entirely, preferably the latter. The opening does not seem to be necessary, and is at all times offensive.

We would also suggest, as a matter of economy as well as greater protection against fire, that the twelve stoves now used to heat the institution be abandoned and steam heat substituted therefor. This is not recommended strictly as a sanitary measure, but we believe it would be a much better and safer way of heating the building.

We believe the sanitary condition of the jail to be such that your board would be warranted in taking immediate action to remedy the defects. The present condition is dangerous to the health of the inmates, and we believe the health of those confined there should not be jeopardized by waiting for the action of the county delegation in regard to the matter.

Should your board decide, as we hope and expect you will, to remedy the present unhealthful conditions at the jail, this Board would gladly render any assistance desired in suggesting the necessary changes and the manner in which they can best be carried out.

It will be seen by the above that very radical changes, involving considerable expense, were called for at the time. The county commissioners, fully realizing the importance and necessity of the alterations suggested, took hold of the work with commendable promptness and made the changes suggested. The old soil pipe, closet, etc., were removed from each cell, and the plumbing in other parts of the building thoroughly overhauled. New soil pipes, terminating in the open air above, have been put in, and connecting therewith is a modern water-closet in each cell with a flushing tank overhead. There are twelve cells, and each has been provided in the manner mentioned. The opening in the floor of the corridor which formerly connected directly with the sewer

without any trap, has been properly trapped and is used now only to drain off the water when the hose is used to wash the concrete floor of the corridor. A bath-tub and sink have been placed in the corridor, greatly to the comfort and convenience of the prisoners.

The bath-tub, wash-bowl, etc., in the jailor's apartments have been thoroughly trapped. Heating by stoves has been abandoned and steam heat substituted. The jail formerly had twelve stoves, it now contains but one, the kitchen range. The heating apparatus has not yet been given a thorough test, but it appears to be ample for the institution. The water supply which has previously been short at times, has been increased by putting in a new and much larger pipe in connection with the street water main. Since this alteration there has been no lack of water.

Numerous minor improvements have also been made, and the condition of the jail at the present time is exceedingly good. One other improvement ought to be made, to wit, better ventilation for the jail. Suitable ventilating flues could be constructed with slight expense, which would greatly improve the atmosphere of the jail. We would especially call the attention of the county commissioners to this point. The sewage of the institution is discharged in an open field at present, so far removed from any residence as to be unobjectionable. There is some question, however, as to how long these conditions will exist.

HILLSBOROUGH COUNTY ALMSHOUSE.

Although some improvements have been made at this institution as they have been absolutely demanded from time to time, yet the entire group of buildings is an aggregation of almost worthless houses. More or less money has been expended each year upon these buildings, still no one of them is what it should be. The main building, or almshouse proper, is a large wooden house, four stories in height besides the basement. This building is so frail and the timbers are so rotten as to give rise to suspicions that in a very strong wind there

is danger of its collapsing. Close examination of many of the timbers showed that they are completely decayed with dry rot, even in the second story. In the main hallway a large timber which supports the hall floor, is badly crumbled with dry rot, and this in a position, too, where it would be least expected. The sills of the building, window-stools, and other portions that admitted of ready examination, were found to be in the same condition — indeed, the state of this building is such as to render it extremely doubtful if it would be worth repairing. The building used for the men's insane asylum is also worthless. The women's insane asylum and the building occupied by the old men were built more recently than the others, hence are in a better condition, but they are cheaply constructed wooden buildings.

The laundry and home for the old women and the schoolroom are located in one building, while adjacent to it is the boiler which furnishes heat and power. The laundry machinery, running six days in the week in the basement, causes much annoyance in the other departments which are directly over it. This arrangement is entirely wrong; the whole building is required for laundry purposes. At the present time all the clothes have to be carried from this building across the yard into the dining-room of the main house, to be ironed after the meals are cleared away. There should also be a separate building for the schoolroom. There are now about 40 pupils. If this institution is to be maintained, these changes should be made. This building is the best of the entire group — in fact, it is the only one that could be suitably arranged for a laundry.

The superintendent's house is also in a state of decay. The condition of these buildings, as regards fire, is one of constant peril, there being nothing whatever to prevent their being entirely destroyed, with great loss of life, should a fire get under headway. There are absolutely no facilities for extinguishing fire. The water supply is wholly inadequate for any such purpose, and with all the force obtainable, water could scarcely be thrown into the second story of the build-

ings. The neglect of the county delegation at its last meeting to provide some remedy for this great danger, as well as for other needs, after having examined and duly understanding the conditions, is inexplicable. The water supply is from a reservoir which was formerly used for a silo, and is elevated but a few feet above the level of the buildings. It is supplied by wind power and two hydraulic rams. There is ordinarily scarcely water enough for domestic purposes, there being times when the supply is insufficient and water has to be pumped from wells on the premises. The present supply is not sufficient to run a system of water-closets in addition to what it is now doing. There is no system of sewers worthy the name at the institution. There are no water-closets, and the old vaults, notwithstanding the efforts of the superintendent, are always in an unsanitary condition.

The only thing to be commended at this almshouse is its administration. All the buildings, wards, and rooms, were in the greatest possible state of cleanliness, indeed it was almost surprising that the walls and floors of some of the rooms could be kept so clean, with wide, open cracks and rough and badly worn boards as were especially noticeable in the men's insane asylum. These cracks in the floors and walls are constant harbors of vermin and it is only by the daily use of insect powder that these pests can be controlled. Every part of the institution was thoroughly neat and clean, the beds in good order, with clean sheets, pillow-cases, and spreads. The greatest praise is to be given the superintendent and matron for their constant efforts and their great success in keeping the institution in so good a condition.

When the present site of the buildings was selected, the county had less than 100 paupers, but with the rapid increase in the population this unfortunate class has increased until it now has over 300 inmates at times in the almshouse. It can readily be seen that an institution designed to accommodate 100 inmates would not be suitably appointed for three times that number.

In view of the present condition of these buildings, we

would recommend, that this location be abandoned, and that an institution ample for the needs of the county be constructed at some more accessible point.

At the time of the inspection there were present 256 paupers, 21 prisoners, and about 60 children.

CHESHIRE COUNTY ALMSHOUSE.

Since our last report on this almshouse the county has erected a brick building on the east side and in the rear of the main house, for laundry purposes and to provide extra room for the insane. The building is two stories high, very thoroughly and substantially built, and covered with metal shingles. A small brick room connected with this building contains a small boiler and engine to furnish power for laundry purposes in the building proper. The first floor is devoted to the laundry, clothes room, drying room, three rooms for the insane, four water-closets, sink, etc. In the second story there are six rooms, besides one containing the sink, water-closet, and bath.

The entire building is finished in hard pine, including walls and ceilings overhead, and is heated by steam. There is a ventilating shaft in the centre of the building, with registers opening into it from the corridors. The rooms are ventilated into the corridors by means of large transoms over the doors.

The second story of this building is connected with the main almshouse by a covered walk. There is a well-constructed basement divided into two parts, one of which is used for a vegetable cellar, and the other for the men's smoking room.

This building is just what has long been needed, except that it is not large enough to provide accommodations for all the county insane. The ward for the insane in the main house, which it was thought might be vacated and used for hospital wards after the building for the insane should be finished, is still occupied by the insane, there not being sufficient room for them in the new building.

The general condition of the almshouse is good. The rooms and beds were very neat and clean.

A few changes should be made. One closet in the main house is still connected with the old sewer or drain which discharges in the field a short distance from the house. This should be connected with the sewer proper. The superintendent's buildings also need some alterations or repairs. It is understood that the county contemplates raising the building and somewhat enlarging it. Something in this direction seems to be necessary.

The institution is under the management of Mr. and Mrs. H. D. Pierce.

SULLIVAN COUNTY ALMSHOUSE.

This county, like some others in the State, labors under the misfortune of having attempted to utilize a set of old farm buildings, by adding thereto, for the purposes of a county almshouse, with the invariable result, of never adequately attaining that end. The buildings were poorly constructed, as well as improperly designed; but with the improvements that have been made from time to time, the general condition of this institution is better than heretofore, although the opportunities for advancement in this direction are by no means exhausted. Improvements have been suggested to the county commissioners by this Board, from time to time, during the past ten years, many of which have been carried out. Only a few years ago the institution was heated by means of more than a dozen stoves, some of which were dilapidated and broken; the insane were kept over the woodshed, in rooms little better than large dry-goods boxes, and receiving but little care; the sanitary arrangements were absolutely bad; the rooms of the almshouse were much in need of paint and paper; there were no fire escapes, and many other conditions were open to criticism. These things have all been changed. A building for the insane has been erected; steam heating put in; the general sanitary conditions improved; fire-escapes provided; and the interior of the building placed

in better condition. During the past year hard-wood floors have been laid in the halls of the almshouse and in some of the rooms; this is a great improvement over the old floors, which were well worn and badly shrunken. The work should extend to other rooms. The privies have been removed to a less objectionable location and are better cared for than formerly.

The administration of the institution appears to be excellent. The rooms were exceedingly clean and neat, and the beds and furniture equally so.

There were 51 inmates at the time of inspection. Among this number were six children, ranging from eleven months to ten years of age. It was especially noticeable that every one of these little unfortunates was bright, pretty, active and fully equal to the average child in mental capacity. Two of the children had no parents at the institution; the other four had mothers only with them. These mothers were wholly unsuitable, from a moral, mental, and physical standpoint, to care for and bring up these little ones.

The building for the insane was scrupulously neat and clean. Five women and one man were constantly confined in it, except when they were allowed out with an attendant. Three of the women were given their liberty inside the building, and were found together in a sitting-room, apparently enjoying this common privilege. The other two were kept locked in their rooms, for the reason that there is no constant attendant in the building, and the three first mentioned are afraid of the other two. It should be stated that a change has recently been made in the management of this institution, and a woman especially interested in this unfortunate class has charge of the insane females. Through her kind care a marked improvement has been brought about among these inmates. Two of the group of three above mentioned were formerly kept in close confinement in their rooms, and their present increased comfort and improvement in personal appearance is due wholly to a little care and kindness, prompted by the Christianity of the woman in charge of them. One of

the two still kept in confinement, had been locked into a close room for years, with no bed, except a mattress and blankets put in at night; no furniture whatever, not even a chair; she wore a print dress not over clean, and went barefooted. She now has a clean and neat bed and a tidy room, which she takes care of herself, and is cleanly and neatly dressed—and this change was brought about in a few days by patience and kindness. This instance is given solely to show that even the incurable insane are capable of great improvement through proper influences, and it is a most forcible argument in favor of the better care of the indigent insane.

The institution is in charge of Mr. and Mrs. Charles Willard.

GRAFTON COUNTY ALMSHOUSE.

This almshouse is in a very good condition, some general improvements having been made during the past year. The buildings have been painted upon the outside, greatly improving their appearance. Many of the rooms have been papered, painted, and whitewashed. This is a great improvement, as the walls had become badly soiled and the paper torn off in many places. The entire building was found to be in a very cleanly condition.

We would call the attention of the county to the suggestions made by this Board in its report of 1889, regarding an increased water supply. The present supply would be wholly inadequate in case of fire.

The general condition of the entire institution is good, and with the necessary improvements from time to time, can be so maintained for many years to come. The changes made by the county during the past five years have been of considerable magnitude and have placed the institution on a par with the other almshouses of the State.

The county maintains on an average 120 inmates at its county farm, at the time of inspection there were present 13 children under fifteen years of age.

Mr. and Mrs. H. R. Norris are in charge.

GRAFTON COUNTY JAIL.

This jail is located at Haverhill. From the street the institution presents the appearance of an ordinary dwelling-house, with L, barn, and stable in the rear. The site embraces some two acres of land. The front or main part of the house is occupied by the jailor's family, while the jail proper is connected with and in the rear of the main house, and is visible from but one point in the road. The buildings were apparently erected many years ago, and are somewhat out of repair. The jail proper is built wholly of stone and brick, chiefly the former. It contains six good sized cells, and is two stories in height, there being three cells in each story, with an ample corridor below, and a stairway and narrow corridor leading to and in front of the upper cells. Each cell has a window and is sufficiently lighted. This jail is said to have been built nearly fifty years ago, and the cells are somewhat larger than those in more modern jails; in this respect it is to be commended.

The sanitary condition of this institution is the most abominable to be found in any institution of its kind — or for that matter, in any other — in the State. It would be difficult to devise a more filthy and disgusting arrangement than is here to be found. Just outside the walls of the jail is a brick and stone vault into which discharge three soil pipes, one for each tier of cells. These soil pipes pass through the jail wall, which is also one wall of the vault, and continue through the floor of the second story cells, and the closet bowls are placed upon the ends of these four-inch soil pipes without any intervening traps. In the lower story the cells are connected with the soil pipes by means of direct branches set at an acute angle with the main pipe, and upon the ends of these branches are fixed the closet bowls for the lower cells. The closets are not supplied with water, and the only means of flushing them is by pouring water from the wash-bowl or pitcher. This amount of water is entirely too small, and, as a consequence, the bowls, both above and below, and the

soil pipes are in a constantly filthy condition. At the time of the inspection three prisoners, two men and a woman, were confined in the jail, and all complained bitterly of the odor from the pipes and vault. The bowls were covered as effectually as possible by the prisoners, to prevent the upward current of air coming directly from the vault, since there is not a single trap upon the soil pipes or the fixtures.

In the jailor's house the sink drain is of the most defective kind. A pipe runs from the sink down through the floor into the cellar, and there connects with a wooden box drain, which delivers the sink water some seventy-five feet from the house. This box drain passes through the cellar wall and is practically open. The sink pipe connecting with this box drain is not trapped. Close beside the box drain in the cellar is a large tank from which the water supply of the institution is obtained, and the over-flow pipe of this tank connects directly with the box drain referred to. A more filthy arrangement could not be devised, and it is not to be wondered at that the jailor last year lost a son from typhoid fever. The sanitary condition of the entire institution is such as to jeopardize the health of all those living within its walls, and should be remedied at once by the county.

Another defect of this jail, from a moral standpoint, is the manner in which prisoners of both sexes are confined in it. A woman prisoner, who was here awaiting trial, was locked into one of the upper cells, while the adjoining cells were occupied by men who had the freedom of the corridor, and could not only pass in front of the woman's cell, and see her through the grated door, but could also converse with her at any time. The woman very seriously objected to her situation, as she had a moral right to do.

If this institution is to be maintained by the county, as it is likely to be for several years to come, it should at least be placed in a good sanitary condition at once, and otherwise brought up to a par with similar institutions in the State. A complete system of improved drainage and sewerage should be put in at once.

The present jailor is Mr. E. B. Morse. He and his family are constantly apprehensive of the dangers to which they are being subjected by the unsanitary condition of the place. They complained that the odors from the sewer are very strongly noticeable in the kitchen and other parts of the house at times, and in order to overcome it chloride of lime is frequently used.

It is but justice to the present board of county commissioners to say that they have just come into office, and it is but reasonable to hope that they will promptly carry out the suggestions offered in this report. The responsibility for the present condition of the institution must rest upon the former board of commissioners, and we can account for the neglect to carry out their promise of reform, only by the fact that two of their number died during their term of office. The following correspondence shows that their attention was called to the condition of the jail, and that an early consideration of the matter was promised.

CONCORD, N. H., October 31, 1889.

Board of County Commissioners, Grafton County, N. H.:

GENTLEMEN,—We desire to call your attention to the unsanitary condition of the Grafton county jail at Haverhill. Complaint has been made to this Board by the local board of health of that town, stating that the plumbing is in a very defective condition, so much so as to endanger the health of the inmates. A fatal case of diphtheria has recently occurred at the jail, and it is believed that the bad sanitary conditions of the institution were a serious factor in the case. It is stated that the drain pipes connecting with the cesspool are untrapped and that the odors and poisonous gases from the cesspool have ready access to the jail building, through these untrapped pipes. Complaint has also been entered from other sources. We are creditably informed that prisoners have complained very seriously of the objectionable and disgusting condition of the drainage at this institution. In view of these facts you are respectfully requested to take such action as may be necessary to place this institution in a good sanitary condition. Our Board will gladly give you any assistance in our power in this matter.

Very truly yours,

(Signed) IRVING A. WATSON, *Secretary.*

LEBANON, N. H., November 4, 1889.

Dr. Watson:

DEAR SIR, — Your communication addressed to Grafton County Commissioners, in relation to Grafton jail and its condition in a sanitary view, is received by me only this afternoon. As you directed to H. H. Holt, Lyme, instead of to me here, it has been so long delayed.

I write you to say we will give it our earliest attention.

Thanking you for your courtesy, I remain,

Yours truly,

(Signed) D. B. EMERSON.

LEBANON, N. H., November 6, 1889.

Dr. Watson:

DEAR SIR, — We find there has been no case of diphtheria at the jail in Haverhill. The jailor's son contracted typhoid fever elsewhere and came home, was sick, and died there. No sickness amongst the confined at the jail.

I am yours truly,

(Signed) D. B. EMERSON.

CONCORD, N. H., November 12, 1889.

D. B. Emerson, County Commissioner, Lebanon, N. H.:

DEAR SIR, — In reply to your favor of November 6, I would say that owing to an error, such as will occasionally occur in a dictated letter, I was made to say diphtheria instead of typhoid fever in referring to the fatal case in the jail in Haverhill. I had reference to the jailor's son who recently died at that place.

Regarding the sanitary condition of the jail, some of the attorneys of Grafton county who have had occasion to go there have complained that its sanitary condition is exceedingly bad, and others have observed its condition. I trust that your board will remedy the defects which cause or admit of this state of affairs.

Very truly yours,

(Signed) IRVING A. WATSON,
Secretary.

The above correspondence is given for the purpose of placing on record the fact that official attention has been directed to the condition of the jail, and also that there was

an expressed willingness on the part of the former board of county commissioners to give the matter their earliest attention. Immediate action by the present board is expected.

A copy of the foregoing report has been placed in the hands of the county commissioners, and we are assured that the jail will be put in a good sanitary condition at once.

COÖS COUNTY ALMSHOUSE.

Since our last report, made two years ago, there has been but little change at this institution, excepting the repairs made necessary by the fire which occurred June 17, 1889, by which the roof of the main building was badly burned and the plastering throughout the house considerably damaged by water. This building, reconstructed from an old farmhouse, was not so well nor so substantially built as it should have been for the purposes of an institution of this character. Thin boards, split in a haphazard sort of a way, were used as substitutes for laths. In many places the seams were too narrow, in others too wide, to give support to the plaster, hence there are frequent large patches where it has entirely fallen off. The plastering was thoroughly repaired after the fire alluded to above, but it has already begun to drop off again. Overhead in the lower hall sheathing has been substituted for plaster, and also in some of the attic rooms. It is proposed to sheathe the upper hall and some of the other rooms. Many of the rooms on the first floor have been painted, both woodwork and plastering, in different colors, making them exceedingly clean and attractive to the eye. This work was done by one of the inmates, so that the only expense incurred by the county was for the materials used. It is suggested that this work be continued throughout the remaining rooms of the institution.

One of the improvements contemplated by the superintendent is the making of a ward for the sick in the upper story, which is a very large, light, and airy room now used as a sleeping apartment by some of the inmates. We believe this change would add much to the comfort of the inmates, and in every way be beneficial to the institution.

The old building in which the violent insane have been confined for several years, still remains in practically the same condition as heretofore. It is an entirely worthless building, wholly unsuitable and inadequate for such a purpose. It is a long, narrow building, having in one end the boilers, laundry, and dry-room, and in the other the latrines for the institution, while in the middle portion there are fourteen small rooms, or cells, for the confinement of the insane patients. The building is a one-story structure, originally built in the cheapest possible manner, now settled and somewhat twisted out of shape, and generally dilapidated. The county needs a new building for its insane.

The general management of the institution seems to be most excellent. The superintendent and matron manifest great interest in their work, and a kindness toward the inmates which is most commendable. The premises were neat and clean.

Mr. and Mrs. Freeman G. Marshall have charge of this almshouse, and at the time of inspection there were 75 inmates, including 15 children. Arrangements had been made to send four of the children to the Orphans' Home at Franklin.

COÖS COUNTY JAIL.

At the session of the legistature in 1889 the Coös county delegation voted to appropriate $5,000 for a new jail, to be built upon the site of the old one, which for a long time had been a standing disgrace to the county. The old jail has been demolished and a new one erected in its place, and while the latter is a great improvement over the former, there are still some defects of construction which the county should remedy at once. The jail proper consists of two tiers of cells, separated by a corridor six feet in width, each tier having six cells, three on the ground floor and three above.

The entrance to the cells is from the inside corridor, to reach which one must first pass into the outside corridor, thence through a door into the inner corridor. The outer

corridor, which extends around the cells on two sides and one end, is very narrow, being only about two feet wide at the sides, while in front it is sufficiently wide to allow room for a stairway to the second inner corridor and cells, which are arranged substantially the same as the lower row.

The cells are built entirely of iron, the outer walls being of iron or steel gratings, while the partitions between the cells, those facing the inner corridor, and the ceilings are of plate iron or steel. The floors are concreted. There is one door in each cell, opening upon the inner corridor and having an aperture through which may be passed dishes not larger than an ordinary tea plate. Each cell has a bunk for the prisoner to sleep upon, and also a water-closet. The entire building surrounding these cells — that is, the outer walls of the jail — is constructed of wood. The method employed in the construction of the cells is different from anything we have heretofore seen, and we must confess that there are obvious reasons why it is not to be recommended as a model.

Entering the outer corridor the first impression reminds one of cages in a zoölogical garden. There is no seclusion whatever for the prisoner, especially if he is unfortunate enough to be assigned to one of the corner cells. It may be that this system has the merit of cheap construction, but if there is any other we failed to discover it. The corridors are too small to allow sufficient room for exercise. The outer corridor is not designed to be accessible to the prisoners. At the time of inspection there were 14 prisoners, only two of whom were allowed access to the corridors.

Among other things open to criticism and which demand the immediate attention of the county authorities, are the following:

1. The entire institution, under the conditions found at the time of inspection, is a veritable fire-trap. No means whatever were at hand to extinguish fire. It should be remembered that the jail is attached to a set of farm buildings, somewhat old, consisting of house, L, and barn, and if a fire should get under headway in that portion of these buildings

adjacent to the jail, it would be impossible to save the prisoners. The county authorities must be held criminally responsible as long as this state of affairs is allowed to exist.

It is recommended that the entire wooden walls surrounding the cells be rebuilt of brick in such a manner as to render it fire-proof, or that some other positive way be devised to protect the prisoners from this great danger. At the time of the inspection not half a dozen pails of water could be obtained at the institution.

2. In the attic of the jail is a tank designed to hold about 100 gallons of water, but it did not then contain a pailful. In the same attic, upon a slightly lower level and directly over each cell, are placed six automatic flushing tanks. A bifurcated pipe is connected with each tank, one arm of which conducts water to the closet in the upper cell and the other to a closet in the lower cell beneath the tank. These smaller tanks, which hold a pailful or more of water, discharge automatically as often as they fill, and at each discharge flush the closets with which they are connected. Inquiry revealed the fact that the water supply has been short for a long time, and as the water is not exactly equally distributed to the flushing tanks, one or two of them were discharging all the water, while the others did not flush at all. Water is also conducted into each cell by means of pipes connecting directly with the flushing tanks, a very unsanitary arrangement, and having faucets attached, so that each prisoner can draw water into a wash basin. As most of the flushing tanks contain a little water at all times, the prisoners have resorted to the practice of drawing it off through the faucet into the wash basin and then using it to flush the closets. The large tank in the attic is supposed to be supplied by a small system of water works owned by private individuals. There is an urgent and imperative demand for an increased water supply.

3. The automatic arrangement of the flushing tank should be changed to one under the control of the prisoner. This is

the only proper way to control the flushing of the closets, and it would also make a great saving in the amount of water consumed.

4. The cells should be better supplied with furniture and bedding. Some of the cells contained nothing whatever except a worthless mattress and a single blanket. Each cell should be provided with a table or stand, a chair, and a reasonable amount of bedding. Some of the prisoners were slightly better accommodated, while one whose crime was a hundred-fold greater than that of the majority confined there, had all the comforts that could be afforded.

5. Some portions of the jail were exceedingly dirty, and the only means of ventilation is by raising or lowering windows, which is, of course, entirely impracticable except during the summer season; and as even this cannot be done by the prisoner, the ventilation depends upon the attention of those who look after the inmates.

While some of the comforts and luxuries found in the one cell alluded to, may possibly have been contributed by friends while the man is awaiting trial, such considerations do not account for the extra liberty allowed him, or the neatness and cleanliness of bedding, cell, etc.

There was much evidence to prove that the management of the jail could be materially improved, and must be in order to place the institution upon a par with similar institutions in the State. The prisoners are required to sweep their own cells. The filthy condition of one, especially, was said to be owing to the fact that the two occupants of the cell refused to do this work, and as a consequence they were being deprived of their food, not having had anything to eat for the previous twenty-four hours. This practice is not required in jails, and it is the duty of the jailor to keep the premises in a cleanly condition at all times.

The prisoners also complained that, greatly to their dislike, they were occasionally placed on exhibition by the servant girl, who had a key to the outer corridor, and who not infrequently had several of her associates in to see the prisoners.

From the positive evidence which was obtained at the time of the inspection, we do not hesitate to say that many changes are demanded at this institution.

PORTSMOUTH SCHOOLHOUSES.

The following report upon the heating and ventilating of the Whipple and Farragut schoolhouses, in Portsmouth, is self-explanatory:

THE STATE OF NEW HAMPSHIRE.

STATE BOARD OF HEALTH.

SECRETARY'S OFFICE.

CONCORD, May 20, 1891.

To His Honor the Mayor and Board of Aldermen, Portsmouth, N. H.:

GENTLEMEN, — In accordance with a request made to this Board by your Honorable Board, to examine the system of heating and ventilation in use at the Whipple and Farragut schools of Portsmouth, we respectfully submit the following brief report with conclusions and recommendations:

An examination of the said buildings was made on behalf of this Board, on May 15, by its secretary and Dr. J. J. Berry, assisted by Prof. E. R. Angell and Dr. S. C. Heffenger.

WHIPPLE SCHOOL.

An examination of this building was commenced immediately after the school opened in the forenoon. Good fires were found in the four furnaces used for heating purposes, and also in each of the two stacks or chimneys for exhaust purposes; therefore, the conditions under which the tests of the ventilating capacity of the system were made were most favorable, and must have shown the system in its best working order, under the climatic conditions of that date.

An examination of the dry closet chambers showed a fairly complete desiccation of the matter deposited therein, with a fairly strong

outgoing current, the velocity of which was not measured. Upon the boys'-side of the house, with a single closet cover raised, there was a downward current of air through the opening at the rate of 235 feet per minute. At the urinals no current was developed, the air being apparently stationary in the pipes leading therefrom. On the girls' side there were four broken covers, and with two open there was a downward current of air at the rate of 205 feet per minute.

Schoolroom, Grade No. 1. (Primary.)

This room has a seating capacity of forty-eight, and there were present forty-two pupils. A careful measurement of this room, with computation of cubic space per pupil, proved it to be ample, and the same may be said of several other rooms whose measurements were taken. It is assumed that the same is true of all the schoolrooms of the buildings examined.

The room is heated and ventilated through an incoming flue in the wall, some eight feet above the floor, and nearly midway of one side of the room; the exhaust, or outgoing flues, are located nearly equidistant from each other in the remaining three sides of the room, in the baseboards, and are ten in number. A measurement of the superficial area of the incoming flue gave 630 square inches, and from this was deducted, after careful measurement, 118 square inches, the loss in superficial area occasioned by the lattice-work across the flue, leaving 512 square inches, superficial area, through which all the incoming air is received. Calculations in the other rooms referred to were made in the same manner. The windows were closed during all the experiments. A measurement by the anemometer gave the velocity of the incoming warm air (fullest amount possible), as 255 feet per minute, equivalent to 21 cubic feet per minute per scholar, or 1,260 cubic feet per hour.

For a better understanding of these and subsequent figures, it may be proper to state at this point that the best medical and sanitary authorities upon schoolhouse ventilation, place 1,800 cubic feet of air per hour as the minimum amount allowable for each pupil. Many authorities regard these figures as too low. It is estimated that 30 cubic feet of fresh air is required per pupil each minute, in order that the carbonic acid gas thrown off by the lungs shall not accumulate to an extent of more than six parts per 10,000. The amount of carbonic acid in the atmosphere of a room is regarded as an index to the amount of organic matter eliminated by the lungs, by surface evapo-

ration, etc. It will, therefore, be seen that the full volume of warm air supplied to this room was considerably less than the minimum amount allowable.

With the warm air shut off, by reversing the damper, the velocity of the cold, fresh air coming in was found to be only 83 feet per minute, equal to seven cubic feet per minute per pupil, or 420 cubic feet per hour, a condition which, if long continued, would render the air intolerable, and extremely dangerous to those confined in it.

The baseboard registers, with warm air turned on, showed a fair outgoing current in eight out of the ten, the two nearest the incoming flue showing no current at all. With the warm air turned off there was a feeble outgoing current in only three of the registers, no movement of air taking place in the others. A momentary reverse current was established through some of the registers upon opening the door into the hall.

Room 6, *Grade* 6.

Thirty-three pupils present. With warm air fully turned on there was a velocity of 220 feet per minute, giving 24 cubic feet of air per minute per pupil, or 1,440 cubic feet per hour. With the warm air shut off and the cold air admitted, it was found that the latter had the greater velocity, 233 feet per minute, giving 25 cubic feet of air per minute per pupil, or 1,500 per hour. It was difficult to account for this condition, except upon the theory that the prevailing current of outside air had a greater propelling influence upon the volume of air in the pipes than did the draft from the stack upon the hot air. With the cold air on, the anemometer revealed a fairly rapid current of outgoing air in the flue nearest the teacher's desk, and slightly feeble currents in only a part of the remaining flues.

Room H.

Velocity of incoming warm air, fullest capacity, 330 feet per minute, equivalent to 28 cubic feet per minute per pupil, or 1,680 per hour. There were 41 pupils present. Temperature of room, 68 degrees F.

Velocity of incoming current of cold air, 190 feet per minute, equivalent to 16 cubic feet per minute per pupil, or 960 per hour.

With the cold air on, two of the baseboard flues showed stationary air, while in the remaining flues the currents were variable. The experiments made in the rooms mentioned were deemed sufficient for the time and purpose. A test of the heating capacity of the

system was, of course, out of the question at that date; but evidence was submitted, showing that the system had failed to heat the rooms to a satisfactory degree during some of the colder days of the winter. The following table presents a brief summary of the results of the investigation, and reveals at a glance the fact that the system as applied to this building is inadequate and unreliable:

Room.	Pupils.	Warm air per hour per pupil.	Cold air per hour per pupil.
		cubic feet.	cubic feet.
Primary	42	1,260	420
Six	33	1,440	1,500
H	41	1,680	960

These figures show that in no case did the amount of fresh air reach even the minimum amount required, 1,800 cubic feet.

FARRAGUT SCHOOL.

This building was visited on the same day as the Whipple school, at about eleven o'clock A. M. The basement contains three furnaces for heating purposes and two exhaust stacks or chimneys. There were good fires in the furnaces and also in the stacks.

Room F.

Velocity of incoming warm air, 180 feet per minute. There were 43 pupils present. Computations upon the required measurements showed that 15 cubic feet of warm air was provided per minute per pupil, or 900 cubic feet per hour. The incoming cold air had a maximum velocity of 170 feet per minute, but the velocity varied greatly, being nearly stationary at times. Calculations based upon the maximum rate showed 14 cubic feet of air per minute per pupil, or 840 feet per hour. Some of the outgoing flues showed a good current, the others variable.

Room I.

The warm air current had a velocity of 245 feet per minute, equivalent to 18 cubic feet of air per minute per pupil, or 1,080 per hour. The cold air current, like that in one of the rooms at the Whipple school, showed a greater velocity than the warm air current, to wit,

260 feet per minute, giving 19 cubic feet of air per minute per seat in this room, or 1,140 per hour. The results may be summarized as follows:

Room.	Pupils.	Warm air per hour per pupil.	Cold air per hour per pupil.
		cubic feet.	cubic feet.
F	43	900	840
I	48	1,080	1,140

Some subsequent measurements of the air currents, made by Dr. J. J. Berry, give substantially the same results as given above.

As will be observed the investigations made by this Board are by no means exhaustive, and embrace only a few of the schoolrooms of these buildings; but we deem the results sufficient for at least a preliminary.

Following is the report of Prof. E. R. Angell, upon the samples of air collected at the time by him:

ANALYSIS OF AIR.

The samples were collected in the Farragut and Whipple school buildings at Portsmouth, Friday, April 17, 1891.

Pettenkofer's test gave the following results:

Farragut School.

Time of day, 3–3.30 P. M.

Room H, Grades 4 *and* 5.— Attendance 40. Temperature, 72 degrees F. Parts of CO_2 per 10,000 parts of air, 13.2

Room F, Grades 8 *and* 9.— Attendance —. Temperature, 69 degrees F. Parts of CO_2 per 10,000 parts of air, 31.8.

Room B, Grades 5 *and* 6.— Attendance 35. Temperature, 66 degrees F. Parts of CO_2 per 10,000 parts of air, 33.7

Whipple School.

Time of day, 3.45–4 P. M.

Room H, Grades 8 *and* 9.— Attendance 41. Temperature, 68 degrees F. Parts of CO_2 per 10,000 parts of air, 18.5.

Room G, Grades 6 *and* 7.— Attendance 37. Temperature, 70 degrees F. Parts of CO_2 per 10,000 parts of air, 17.1.

A sample was taken from Room A, but the bottle containing it was accidentally broken. All the rooms have the same seating capacity, 46.

(Signed) EDMUND R. ANGELL.

From our investigations and the evidence presented we arrive at the following conclusions:

1st. That in both the Whipple and Farragut schools some, and probably all, of the rooms are insufficiently ventilated.

2nd. That in both the Whipple and the Farragut schools, especially the latter, the present system of heating is inadequate in the coldest weather.

3rd. That the "dry closet," so called, under the conditions existing at the time of examination, is defective, and liable to endanger the health of the pupils and teachers.

Inasmuch as the system of heating and ventilation was at the time of inspection being operated at its greatest capacity, we cannot see how it is to be improved sufficiently to meet the requirements of health and comfort without very radical changes. While there are several ways by which the desired results can be secured, we would recommend the following:

1. To abandon the several furnaces now in use, and substitute in each building one furnace and boiler, with coils for steam and fan blower combined. This system could be easily connected with the present flues without any material alterations, and would ensure at all times an ample amount of heat and fresh air. The steam coils and blower would occupy only a small space adjacent to the boiler, and no piping of the building would be necessary. The cost would probably be less than that of any other plan that would assure from the start satisfactory results. This system is in successful operation in buildings that could not be properly heated and ventilated by the Smead plan.

2. We would unqualifiedly condemn, as contrary to the best principles of sanitation, the so called "dry closet," and wherever sewers can be reached and water-carriage employed, the "dry closet" should not be allowed. If the Smead system of heating and ventilating is to be used, it should be divorced from the "dry closet" attachment. The theory of the system is admirable, but practically it is faulty and dangerous under some circumstances and conditions.

Finally, we would respectfully suggest that the conditions found at both the schools mentioned are serious and demand an immediate

remedy. The good health and welfare of the children are dear to every parent, indispensable to every child, and invaluable to the greatest prosperity of the commonwealth.

Respectfully submitted,

IRVING A. WATSON, *Secretary.*

VENTILATION OF THE STATE HOUSE.

The almost intolerable condition of the air in the Representatives hall during the session of the last Legislature — the first winter session — caused the enactment of a resolution by that body requesting this Board to investigate and report upon the matter. A full record of the action of the Legislature and of the Board upon this subject is given in the following report made to that body in April last.

To the Honorable Senate and House of Representatives:

The following concurrent resolution, passed by the House of Representatives and the Senate, was submitted to the State Board of Health March 16, 1891:

Resolved, That the State Board of Health be and is hereby requested to carefully investigate the existing methods of ventilating and lighting the hall of the House of Representatives, and that the said Board be also requested, if in their judgment they deem it advisable, to formulate plans for the better ventilating and lighting of said hall, report thereon to be made to the present Legislature, with estimated cost of the necessary changes and improvements.

In accordance with the above resolution the Board immediately commenced an investigation of the matter under consideration, and secured the services of an expert sanitary engineer to assist in reaching definite conclusions and in formulating plans for a satisfactory system of ventilation.

Owing to the probable early adjournment of the Legislature and the consequent very limited amount of time in which to consider the matter, it is impossible to make more than a preliminary report at this time.

The present ventilation of Representatives hall consists of a certain small amount of air which enters the hall through the doorways,

and a somewhat larger amount which passes out through the two openings in the ceiling. This circulation of the air has very little value as a means of ventilation, inasmuch as the amount of air entering and leaving the room is altogether too limited in quantity, neither is the incoming air properly mixed with the vitiated air of the room. Futhermore it is probable that a large proportion of the air passing out at the ceiling enters at the gallery doors and does not assist in the ventilation of the hall. A careful measurement of the hall shows that with every representative in his seat and an average attendance in the gallery, there is still ample cubic space for each individual, if a sufficient amount of warmed, pure air is introduced, which it is perfectly feasible to do.

The outside atmosphere contains about four parts of carbonic acid gas to each 10,000 parts. Air that is breathed into the lungs is relieved of a part of its oxygen and when exhaled contains a larger proportion of carbonic acid. The carbonic acid indicates the relative amount of organic matter contained in a given atmosphere, and is thus regarded as a test of the amount of poisonous matter present in the atmosphere, exhaled from lungs, skin, etc. If we assume that ten parts of carbonic acid per 10,000 parts is the safe limit, then it only becomes necessary to determine how much fresh air must be supplied to limit it to these figures.

After a careful study of the room in question and the amount of air supplied by the door openings — which are very often closed — it is estimated that the atmosphere of the hall, under the existing circumstances, becomes vitiated to an unhealthful degree in about thirteen minutes. And when to this is added the amount of air exhausted by gas burners on dark afternoons and evenings, it is believed that the air becomes unfit for respiration in about ten minutes. In order to keep the conditions of the air within the safety limit of healthfulness, it is estimated that it would be necessary to remove 10,000 cubic feet of air from Representatives hall each minute, basing the calculations upon a full attendance of members upon the floor and one hundred persons in the gallery.

The plan recommended by the Board consists of taking a supply of air from outside the building through an opening in the cellar wall into a chamber built of brick. The air is to be warmed by passing over a steam coil of 800 square feet heating surface, thence up through a flue to a chamber in the lobby, from which it will be delivered to the Representatives hall by an opening through the wall 25 inches by 168 inches, located just below the gallery.

A division in the basement chamber will allow the cold air to pass directly up the flue without coming in contact with the heater, or to pass through the heater, or be mixed in the flue, so as to deliver into the hall at any desired temperature. A mixing valve or damper is to be put in the cellar, so arranged as to be worked from the lobby, which will regulate the temperature of the incoming air without reducing its volume.

The warm air comes through the opening in the wall at an angle of about 50 degrees and is thrown across the top of the room. The three windows on each side condense the air coming in contact with them and will therefore cause a constant flow toward them of the air from the top of the room. The exhaled air will rise and mix with the incoming fresh air so as to be thoroughly diluted. After losing a few degrees of heat the air will drop to or near the floor. Thus it will be seen that we have a stratum of cold and impure air near the floor which would have to be removed. In removing so large a quantity of air (10,000 cubic feet per minute), it is advisable to take it from several points in order to avoid any uncomfortable draft. It is, therefore, proposed to take the foul air through six registers placed in the floor at the rear of the seats, dividing the length of the room about equally.

The air passes through these registers into a duct under the floor and thence to one corner of the room, where it passes through the wall into a duct built in the lobby, thence up through the end of the gallery and into the attic room. It is proposed to build a chamber across the attic to the stairway already built, thence by the stairway and a duct of equal capacity into the well where the spiral stairway now is, and by this well to the top of the dome, discharging by the upper window openings, after the windows and casings have been removed to give full size.

The gallery will have a duct at one end adjacent to the main room flue, and also one at the rear, this being advisable on account of the great length as compared with the width.

There is a flue already constructed, connecting the basement with the space under the hall floor, but this would have to be enlarged in order to allow the passage of a sufficient quantity of air.

Many parts of the building are exceedingly inflammable, hence it would be necessary to have all the ducts lined with galvanized tin, as a spark from a burning match or cigar might be rapidly sucked into them. The entire plan is not only feasible, but owing to the height of the outgoing flue, complete and satisfactory ventilation is absolutely

assured. The old flue above mentioned is utilized in the plan proposed, and the entire system can be put into operation with comparatively slight disturbance to the building. Indeed the building is so constructed that the plan can be carried out with great practicability.

The Board is now having made accurate plans and specifications, but cannot at this time give a reliable estimate of the cost. These plans and specifications will be ready in a very short time for such disposition as the Legislature may determine upon.

Complaints which have been made to the State Board of Health during the present session of the Legislature, by many of the representatives, indicate that many have suffered from headaches, general lassitude, nervous irritability, and other conditions more or less induced by insufficient and impaired ventilation. Other conditions quite serious have been complained of, and the Board deems it a public necessity that better ventilation should be secured for Representatives hall. We therefore present the following conclusions:

1st. That the ventilation of Representatives hall is entirely inadequate under the present conditions.

2nd. That complete and satisfactory ventilation can be secured at a reasonable cost and without detracting from the beauty or convenience of either hall, corridors, or rotunda.

In view of these facts we would respectfully recommend that the Governor and Council be authorized to construct, out of any moneys in the treasury not otherwise appropriated, a system of ventilation for Representatives hall, according to plans and specifications recommended by the State Board of Health.

Respectfully submitted,

IRVING A. WATSON,
Secretary.

As a result of the foregoing report the following (chapter 124, Laws of 1891) was enacted:

Resolved by the Senate and House of Representatives in General Court convened:

That the Governor and Council be authorized to construct, out of any moneys not otherwise appropriated, a system of ventilation for Representatives hall and Senate chamber according to plans and specifications recommended by the State Board of Health, or such other plan as they may see fit to adopt.

[Approved April 11, 1891.]

AN IMPORTANT DECISION ON A SLAUGHTER-HOUSE NUISANCE.

A slaughter-house situated in the town of Littleton, and which for several years had given offense to people residing in its vicinity, was effectually suppressed by injunction. Whenever there are difficulties standing in the way of a prompt abatement of such nuisances by the local board we would recommend a procedure like the one taken in the case cited. Below is given the decree of the court in the case:

GRAFTON SS. IN THE SUPREME COURT. MARCH TERM, 1891.

LORENZO D. COCHRANE *v.* DEAN C. PHILLIPS.

PETITION FOR INJUNCTION.

DECREE.

The said petition having been duly filed in the office of the clerk of said court at Woodsville in Haverhill in said county on the thirtieth day of March A. D. 1891, and the petitioner having been ordered to notify the said Dean C. Phillips to appear before said court at Thayer's hotel in Littleton in said county on the 20th day of April A. D. 1891, at 4 o'clock in the afternoon, then and there to answer to said bill of complaint by giving in hand or leaving at the usual place of abode of said Phillips a true and attested copy of said bill and the order of court thereon, at least fourteen days before said time of hearing: and said order of notice having been duly complied with by said petitioner, and both the said parties having appeared in person at the time and place aforesaid with their evidence, witnesses, and with their solicitors: and the parties, the witnesses and other evidence, and the suggestions of counsel having been heard and considered by the court.

It is ordered and decreed that the slaughter-house complained of and described in said petition, is a nuisance, and that it be abated: that the further use of the said buildings of the said Phillips described in said petition as a slaughter-house be discontinued, that there be no deposit of animal and vegetable matter liable to decay and become offensive, or the refuse of slaughter-houses and of the butchering on or about said premises: that swine shall not be kept or pastured in or about said buildings in such numbers or in such manner as to cause odors of-

fensive to persons dwelling in the vicinity thereof, or to make the waters foul in the stream described in said petition: that the said Phillips remove the manure, refuse and animal matter under and about said slaughter-house, which is liable to make the atmosphere offensive or to foul said waters, and that he make no other use of the premises which shall make them offensive to those dwelling in the vicinity on account of foul odors, or which shall make said waters foul and unwholesome: that the said Phillips shall not suffer or permit his agents, employees, servants, or lessees to do anything on the premises or make any use thereof contrary to the orders aforesaid: and that the said Phillips pay the plaintiff's costs taxed at twenty-seven dollars and seventy-seven cents, and the cost of the copy and service of this order.

April 20, 1891. W. H. H. ALLEN,
Presiding Justice.

STATE OF NEW HAMPSHIRE.

GRAFTON SS. SUPREME COURT CLERK'S OFFICE, April 29, 1891.

The foregoing is a true copy of the decree in the before entitled cause.

In witness whereof I have hereunto set my hand and affixed the seal of said court.

CHAS. B. GRISWOLD, *Clerk.*

THE PREVENTION OF TYPHOID FEVER.

SOMETIMES CALLED "ENTERIC FEVER," "GASTRIC FEVER," "PYTHOGENIC FEVER," "CESSPOOL FEVER," ETC.

Typhoid fever is one of the preventable diseases, and sanitarians and physicians very generally agree that there is no excuse for its existence in any community. This opinion is based upon the fact that intelligent and well-directed efforts to restrict the disease are attended with most successful results, thereby proving that the laws through which it operates are well understood by those who have studied the subject and that the disease is capable of being controlled by proper measures.

On an average, about 150 deaths are annually reported in

this State as having occurred from typhoid fever. This mortality represents from 1,200 to 1,500 cases of the disease annually. A large proportion of this mortality can and ought to be prevented.

The greatest number of deaths from this disease is of persons in the prime of life, and this should prompt to greater efforts for the prevention of the disease. Persons of all ages are liable to it, and although it may appear in a mild form in many instances, yet such cases may be the medium of communicating the disease in a fatal form to others. Although it is not one of the most contagious diseases, *it is communicable to others.*

It is not considered directly transmittible from the sick to the well, but the patient eliminates from his person, chiefly through the excreta, the germ which produces the disease. The germ will soon perish if not placed under conditions favorable to its development; but any mass of decomposing organic matter, such as cesspools, filthy drains, damp and unclean cellars or rooms, etc., and filth in any form, affords a fertile soil for the reproduction of the typhoid fever germ. Hence it follows that privy vaults, cesspools, filthy drains, etc., become centers of contagion, and dangerous localities when typhoid fever is prevalent. The danger from them is vastly increased, because the fluid portion of their contents, charged with the germs of disease, permeates the soil and is often carried by underground water currents to neighboring wells, which in this way become poisoned. If there is any weight in the testimony of close observers and careful investigators, then the evidence is overwhelming that typhoid fever is a filth disease. So general is the belief that filth in some form is necessary to support this disease, that its very name suggests uncleanliness, defective sewerage, bad drainage, foul vaults and cellars, filthy sink drains, contaminated drinking water, etc., etc.

The poison of typhoid fever may possibly sometimes be inhaled into the system, but in the great majority of cases the disease germ undoubtedly finds its way into the intestinal

canal by means of the food and drink. Reflection will show, and experience teaches, that there are many ways in which our food and drink may become contaminated with the germs. Some of the more frequent ways are these: The discharges are thrown into the privy or upon the ground, whence they soak, sometimes long distances, through the soil into the family well. The soiled clothes of the patient are washed, and the water carried by a loose and leaky drain which runs too near the well. Some kinds of food and drink are very absorptive of disease germs, and being kept too near the patient, become contaminated. Cases are known where milkmen, with fever at their own homes, have caused serious outbreaks of the disease among their customers, by keeping the milk, before it was distributed, too near the sick, by diluting it with contaminated water, or even by rinsing the cans with such water.

PREVENTION.

1. Keep your premises at all times in a good sanitary condition. Filth is the *nidus* in which the cause, or germ of of the disease may be developed. Of all forms of filth none others are so dangerous to our homes as the "hole-in-the-ground" privy, and the sink drain. The former should never be tolerated, nor the latter, either, in its usual forms.

Filth in its sanitary signification, includes not only the grosser forms but also the less tangible and more *respectable* kinds which are too often ignored. The impalpable but not inodorous air of unventilated bedrooms is disgusting and dangerous; the sewer-air which leaks from faulty water-closets or defective drain pipes in the homes of the wealthy consigns many to the tomb; the emanations from rotting chips or sawdust; the exhalations from decaying vegetables in the cellar, — all these may dangerously pollute the air, and should be avoided.

2. All discharges from the fever patient should be received in a vessel containing a pint or more of Solution No. 1, and kept covered by the disinfectant three or four hours, and then

buried in the earth where they cannot by any possibility find their way into wells, springs, or brooks. *They should never be allowed to mingle with any kind of filth, in a privy or elsewhere.*

The clothing, both of bed and patient, should be disinfected by dropping it into a tub containing several gallons of Solution No. 2, and should be kept therein until it can be boiled. After death or recovery disinfect the room by sulphur fumigation followed with washing the floors and other woodwork with Solution No. 1, or No. 2.

3. As far as concerns the personal hygiene of nurses and attendants, it may be said that, if the foregoing preventive measures are carefully carried out, there is hardly a possibility of their taking the disease; in fact, under such conditions, cases in which the attendants have taken the disease from the patient are almost if not quite unknown. Typhoid fever goes through families because all have been exposed to the disease-producing cause; or the first cases contaminate the water supply, or "seed down" the privy-vault and the house surroundings with the disease germs.

Nurses and others in the family should eat nothing in the room where the patient is, nor anything which has been there. The food for the attendants and family should be prepared and kept as far from the sick as possible. Thorough boiling will kill all disease germs; so, while the fever is in the house, it is safer to boil all water and milk just before it is used.

Bodies of those dead from typhoid fever should be wrapped in a cloth wet with either Solution No. 1, or Solution No. 2, and at once buried.

The room in which there has been a case of typhoid fever, whether fatal or not, should, with all its contents, be thoroughly disinfected by exposure for twenty-four hours to strong fumes of burning sulphur immediately after it has ceased to be occupied by the patient, and then it should for several hours, if possible for days, be exposed to currents of fresh air.

Upon the discovery of a case of typhoid fever by the attend-

ing physician, he should immediately notify the local board of health and should coöperate with the board to restrict the disease. Upon receiving such notice the local board of health should:

1. Give public notice of infected places, so that no person may unguardedly drink water or take food from a source likely to be contaminated or unduly expose themselves to the disease.

2. Investigate the probable source and mode of origin of the disease. If probably from a contaminated well or general water supply, see that measures are taken by stopping its use, by boiling it, or otherwise to prevent further cases being caused in the same manner. If connected with the sewer, see that the plumbing is in good order and all fixtures properly trapped.

3. Order and enforce the disinfection of all discharges from the bowels of patients sick with typhoid fever. It is safest that the discharges of all persons who have diarrhœa shall be disinfected.*

4. Disinfect the contents of the privy on the premises, or any other that has been used by the patient. †

5. Order and secure the disinfection of all articles of clothing or bedding that have been soiled by discharges from the patient.

6. Secure the coöperation of the people in the prevention of this disease, by teaching them its modes of spreading, the best methods for its prevention, and the greater importance of efforts for its prevention in times of drought and low water in wells. ‡

7. See that the premises are properly disinfected after the death or recovery of the patient.

* For this purpose use disinfectant No. 1 freely.

† To keep a privy-vault disinfected during the progress of an epidemic, sprinkle chloride of lime freely over the surface of its contents daily, or use a quart of Solution No. 1 daily.

‡ Wells are more dangerous at times of low water, because the area of drainage to the well is greatest when the water is the lowest.

DISINFECTANTS.

*Solution No. 1.**

Chloride of lime (bleaching powder), . . one pound.
Water, ... four gallons.
Mix.

All clothing or bedding soiled by the patient's discharges, must be removed *at once, and placed in boiling water, to be boiled for half an hour*; or they may be immersed in the following solution, allowing them to remain for two hours, when they may be rung out and sent to the laundry to be thoroughly boiled:

Solution No. 2.

Sulphate of zinc, ... one pound.
Common salt, ... one half pound.
Water, ... four gallons.

Nurses and attendants should observe perfect cleanliness, and their hands should be frequently bathed in Solution No. 2.

Fumigation with Sulphur

has ever been regarded as a reliable method of disinfecting a house, and should be resorted to after a case of small pox, diphtheria, scarlet fever, or typhoid fever, and in such other cases as the attending physician may think best. To do this, the house must be vacated. Heavy clothing, blankets, bedding, and other articles which cannot be treated with solution, should be opened and exposed during fumigation, as follows: Close the room as tightly as possible, place the sulphur in iron pans supported by bricks placed in wash-tubs containing a little water, set it on fire by hot coals or with the aid of a spoonful of alcohol, and allow the room to remain closed for twenty-four hours. For a room about ten feet

* For a free and general use in privy-vaults, sewers, sink drains, refuse heaps, stables, and wherever else the odor of the disinfectant is not objectionable, this is one of the cheapest and most effective disinfectants and germicides available for general use.

Chloride of lime ought to be obtained anywhere for ten cents a pound. In some places it can be obtained for five cents a pound.

This is one of the best disinfectants known.

square, at least three pounds of sulphur should be used; for larger rooms, proportionally larger quantities. Heavy woolen clothing, silks, furs, stuffed bed covers, beds, and other woolen articles, which cannot be treated with disinfectants, should be hung in the room during fumigation, their surfaces thoroughly exposed, and their pockets turned inside out. Afterward they should be hung in the open air, beaten and shaken. Pillows, beds, stuffed mattresses, upholstered furniture, etc., should be cut open and their contents spread out and thoroughly fumigated. Carpets are best fumigated on the floor, but they should afterward be removed to the open air and thoroughly beaten.

REMARKS.

Disinfection, following every infectious or contagious disease, should be carried out under the supervision of the local board of health, or by some competent person authorized by the board. Much of the so called disinfection practiced by many families is wholly inefficient and useless. The odor of burning coffee, tar, sulphur, or any other substance in the sick-room, or other part of the house or premises, in the presence of the patient, or other persons, operates only as a deodorizer, and does not destroy the germs of the disease. This is an important fact that every family should understand.*

CAUSES OF TYPHOID FEVER.

Typhoid fever is perhaps more than any other disease dependent upon unsanitary conditions for its prevalence. We have repeatedly shown this fact in the former reports of this Board. The testimony of the physicians in this State year after year adds home evidence to the extensively recorded causes of this disease. All the records of typhoid fever epidemics in this country and elsewhere abound with the most

* The foregoing paper is issued in pamphlet form by the State Board of Health for gratuitous distribution throughout the State. A copy may be obtained by applying to the Board.

incontrovertible proofs that filth, so called, in some form is the important factor in the spread of this disease. At the last meeting of the Sanitary Institute of Great Britain, Dr. George Vivian Poore presented the record of the reported epidemics of typhoid fever in England for thirty years, and the facts are so overwhelming in proof of a filth cause, that we give the record complete. The lesson it teaches is applicable to every community and to every home in New Hampshire.

CAUSES OF TYPHOID FEVER.

In 1858, at Windsor, 400 infected; 26 deaths. Slovenliness as to removal of filth; offensive pig-sties; unregulated slaughter-houses; unremoved refuse; obstructed surface drainage. Three fifths of the houses supplied from surface wells, sometimes in proximity to undrained premises, or imperfect drains. Sewerage without adequate exterior ventilation, and so ventilating itself into houses. On account of the summer drought, the sewer atmosphere at maximum of poisonousness.

In 1859, at Kirkby-Stephen, one seventh of the 1,500 inhabitants infected; 11 deaths (Typhoid or Typhus?). Bad drainage. Sewerage draining into drinking-wells. Accumulation of excrement in proximity to houses.

In 1859–60, at Bedford (autumnal epidemic for some years), 30 deaths per annum from fever and diarrhœal diseases. Water contaminated with decaying animal matter. Cesspools universal — upwards of 3,000 of them. Water supply from wells frequently in close proximity with cesspools. Water both in cesspools and wells rises and falls with river.

In 1860, at Bath (Bathwick), 35 houses infected. No sewerage. Cesspools general. Defective house drains leaking beneath houses. Fæcal putrefaction in air and drinking water.

In 1859–60, at Kingston-Deverill (Wilts), 66 (out of population 400) infected; 6 deaths. First contagium imported. Badly-ventilated houses. Not attributed to sewage-tainted water or sewage-tainted breathing air; probably to want of precaution in dealing with evacuations.

In 1859–60, at Dronfield, 556 (out of 2,500 inhabitants) infected; 41 deaths. Sanitary neglect. Accumulation of animal filth in privies, cesspools, pig-sties, slaughter-houses, and drains. Drainings

soaking through house walls. Refuse draining itself to dammed-up brook in valley; two much-frequented wells habitually in danger of pollution from this brook.

In 1861, at Calstock (Gunnislake), 213 infected; 12 deaths. Accumulation of excrement, slops, and decaying animal and vegetable matter. Deficient privy accommodation. No efficient house drains or sinks. An unusual number of filthily-kept pigs and of putrid and overflowing refuse pits and heaps.

In 1861, at Over-Darwen, 1,000 infected; 35 deaths (some of these registered as "Typhus"). No system of drainage, or of scavenging. Night soil, ashes, and general refuse allowed to accumulate for months and years. Overcrowding. Water and liquid refuse making for themselves channels in the unpaved streets.

In 1861, at King's Langley, 16 infected; 2 deaths. Drains opening near cesspools pass between or beneath houses; in hot weather offensive stinks proceed from these drains. Drinking-wells in danger of contamination from cesspools. Filth and excrement allowed to accumulate from deficient scavenging.

In 1861, at Yeadon, 130 infected; 11 deaths. Deficient privies and deficient scavenging. Drains communicating with dam whence water is pumped to mills, and there boiled for trade uses. Open gutters, into which slops are thrown. One drinking-well liable to sewage fouling.

In 1863, at Whitehaven, 1,000 infected; 110 deaths (including 17 registered in St. Bees). Overcrowding. Bad ventilation of houses. Bad privy accommodation. Bad scavenage. Practically no drainage. Absolutely none for water-closets. Gutters running down courts carry off surface water, and whatever else may happen to escape from middens, piggeries, etc., or be thrown therein.

In 1863, at Festiniog, 600–700 infected; 67 deaths. Great majority of houses without privies or ash-pits. Fields and house utensils are used — the latter being emptied near the houses. Streams in valleys polluted by rain water washing down excrement from houses. This water supply only used for domestic and not drinking purposes. Drinking water from mountains free from pollution. Great overcrowding. Cold and wet attributed as causes. Such privies as exist are generally offensive.

In 1863–4, at Grantham (including Spittlegate); 22 deaths. Impure water. The drinking water (spring water) became mixed with the river water. This latter receives part of the drainage of a village.

In most cases the effluvia from accumulated human excrement are blamed, from untrapped drains, imperfect sewers, and bad system of privies.

In 1865–6, at Buglawton, 150 infected; 14 deaths. Only superficial sewers, receiving rainfall, house slops, and in some cases midden excrement. Foul smells from untrapped sewers. Middens in common use, but scavenage very bad. The river dam receives the sewage of many houses, and from this river near where sewage enters, water for domestic use is obtained. Drinking water from well liable to contamination from privies adjacent. Water analysis proves the contamination. "Facts point to specific contamination of the well water by typhoid poison, derived from the first patient in the house adjacent to the well."

In 1864–5–6, at Tottenham (Page Green), 100 infected; 2 or 3 deaths. Where fever occurred, the drinking water was wholly or in part from surface wells. Some of these wells liable to surface and sewage contamination. Water analysis showed organic impurity.

In 1865–6, at Winterton, 100 infected (ex. 145 inhabitants); 17 deaths. In 1867, 55 infected; 6 deaths. Disgraceful state of privies, cesspools, ash-pits, and wells. Contents of privies running into gardens, often penetrating into wells. Refuse, slops, urine thrown into yards, or deposited into open cesspools. Urine and bowel discharges of typhoid patients thrown into open ash-pits. These sources of fæcal fermentation situated close to the houses, and in immediate vicinity of wells. Untrapped drains communicating with main sewer evolving stinking effluvia. Within a circuit of fourteen feet round a drinking-well are an open drain, an open ash-pit, two pig-sties, three privies, and one open cesspool, all (except the drain) raised from one and one half to three feet above the well, and situated on a loose porous soil.

In 1867, at Guildford, 500 infected; 21 deaths. Sewer receiving mainly surface water, receives excreta from certain water-closets, and the overflow of certain cesspools; some privies also discharge their liquid excreta into this sewer. Sewer runs within ten feet of well, and by percolation and by a fissure in the chalk, excrementitious matter leaked from the sewer to the well.

In 1867, at Terling, 300 infected (ex. 900 inhabitants); 41 deaths. Slops, ashes, manure-heaps, broken-down privies and cesspools surround the cottages; drinking water is obtained from wells at a lower level, and separated by loose porous soil from the above nuisances.

The remaining drinking water is got from ponds into which drainage from the fields and roads run, or from river water contaminated by sewage. Overcrowding everywhere.

In 1869, at Wicken-Bonant, 45 infected; 4 deaths. Privy of first house affected with typhoid stands on edge of water channel; the undisinfected stools were thrown into the privy; thus the excrement got from privy to brook, and the brook communicated with the parish well. The method of infection in the first patient is uncertain, but was caused in some manner by typhoid fever previously imported from London.

In 1870, at Annesley (Notts). Arrangements for excrement disposal and water supply such that people must drink their own excrement.

In 1870, at Appledore and Northam (Devon). Streets and courts ill-constructed and ill-drained, with excrement and refuse lying about everywhere. Water sources befouled. "Epidemics of enteric and scarlet fevers."

In 1870, at Coventry (neighborhood of). "Enteric fever seriously prevalent." Ascribed to use of polluted water, want of efficient sewerage, and various accumulations of filth.

In 1870, at Croyde (Devon). "Serious prevalence of enteric fever." No public sewerage or house drainage. Excrement and refuse accumulations. Pig-sties and dung-heap nuisances, sometimes polluting the water.

In 1870, at Penryn (Cornwall). "Considerable outbreak of enteric fever." Streets lined with excrement and refuse. Want of sewers, privies, and ash-pits. Water sources polluted.

In 1870, at Rolvenden (Kent). "Enteric fever epidemic." Water supply polluted. Want of drainage and proper means of excrement disposal. Abundant nuisances.

In 1870, at Spinkhill (Derbyshire). "Habitual prevalence and present outbreak of enteric fever." Water of public and other wells polluted. Drains defective. Want of privies and ash-pits. Filth accumulations.

In 1870, at Ystrad-y-fodwg (Glamorgan). "Great prevalence of enteric fever." Neglect of all sanitary precautions. No due provision for excrement or refuse disposal. Water supply insufficient and liable to pollution.

In 1871, at Brackley (Northampton). "Epidemic of typhoid." Accumulation of excrement. Wells near cesspools.

In 1871, at Bulwell (Notts). "Epidemic of typhoid." Pollution of water by excrement nuisances. Privies filthy and insufficient.

In 1871, at Burbage (Leicestershire). Epidemic of typhoid fever, connected with use of water from a well communicating with a privy probably infected by an imported case of typhoid. Bad excrement management, and improper water supply generally.

In 1871, at Calstock (Cornwall). Frequency of typhoid epidemic. Continuance of unwholesome conditions previously reported. (*Vide* 1861.)

In 1871, at Carlton (Notts). "Enteric fever epidemic." No proper water supply. Privies few and bad. Nuisances abounding.

In 1871, at Helions-Bumpstead (Essex). "Epidemic enteric fever." Great accumulations of excrement and filth. Foul ditches. Much of water supply polluted.

In 1871, at Higham-Ferrers (Northampton). "Habitual prevalence of enteric fever." Ground sodden with leakage from privy pits and cesspools. Water polluted. Insufficient ventilation of sewers. Accumulations of excrement and house filth. Trade nuisances.

In 1871, at Hugglescote, Donnington, Coalville, Packington (Leicestershire). "Enteric fever severely epidemic." Air and water polluted by excrement. No proper drainage. Nuisances from privies and pig-sties.

In 1871, at Ilminster (Somersetshire). "Considerable epidemic of enteric fever." Foul open sewers. Excremental filth everywhere, saturating ground and contaminating most of drinking water.

In 1871, at Packington (Leicestershire and Derbyshire). "Severe epidemic of enteric fever." Water supply polluted. Serious accumulations of excrement and other filth.

In 1871, at Sunderland. "Epidemics of typhus, typhoid, and small pox." Overcrowding. Defective drainage. Improperly regulated water-closets. Excremental nuisances. Defective water supply.

In 1872, at Ashton-in-Makerfield (Lancaster). "Epidemic of typhoid fever." Insufficient water supply, and partly from questionable sources. House drainage bad. Accumulations of excrement. Want of scavenging.

In 1872, at Sherborne, 243 infected. Water in surface mains exposed to contamination from water-closets by excrement and sewer air. In some cases the specific contagium of typhoid would thus enter the water pipes. This entrance to the water pipes was made possible on account of the water supply being itself shut off near the supplying reservoir. Water-closets defective; filthy privies in the town with large pits, producing soil saturation and air pollution. Inefficient sewerage and drainage. Overflow of bath pipes (in some instances)

communicating with soil pipes or drains. Remains of old sewers and dead wells in the town evolving foul smells. Public water supply good, but in addition several wells exist in the town exposed to contamination from soil of privy pits or leakage from old sewers.

In 1872, at Armley, 107 infected; 11 deaths. Defective drainage. Large privy cesspools the usual thing. The earth upon which the dwellings stand is polluted with soakage from drains and cesspools. Typhoid first attacked dairyman and then spread to a large number of his customers. His well was found to be extensively contaminated with sewage.

In 1872, at Abingdon. Water supply mostly from surface wells in porous soil soaked with excremental and other filth. Sewerage defective. Sub-soil in part water-logged. Privy and water-closet nuisances. Accumulations of excrement. "Enteric fever and diarrhœa."

In 1872, Burton-Latimer (Northampton). "Typhoid epidemic." Water supply obtained from wells polluted by soakage from privies and cesspools. Sewerage and drainage defective. Accumulations of excrement and refuse. Nuisance from piggeries. Overcrowding.

In 1872, at Huddersfield. "Typhoid epidemic." Sewers defective. Certain water supplies largely polluted with sewage.

In 1872, at Leigh (Lancashire). Privy accommodation insufficient. Polluted water used from wells close to drains, privies, and middens. Accumulations of excrement. Imperfect sewers. Badly constructed and arranged houses.

In 1872, at Olney (Bucks). "Constant prevalence of enteric fever." Imperfect drainage. Soil round wells sodden with soakage from privies. Cottages without privies or ash-pits. Accumulation of excrement.

In 1872, at Swinton (Yorks). "Enteric fever endemic." Soakage of excremental filth into wells. Accumulation of excrement and filth.

In 1872, at Wellington (Somerset). Water liable to pollution. Imperfect sewerage and drainage. No system for removal of refuse. Nuisances from manure, pig-sties, and slaughter-houses.

In 1872, at Whitchurch (Hants). "Enteric fever." Water obtained from wells sunk in porous soil saturated with sewage. No proper sewerage system. Nuisance from piggeries.

In 1873, at Wincanton (Somerset). "Continued prevalence of enteric fever." Foul privies and drains. Air and soil polluted by sewage. Cesspits. Water supply from reservoir polluted.

In 1873, at Brecknock. "Enteric fever." Defective drainage. Cesspits leaky and rarely emptied; pollution of soil water. Badly-constructed privies. Nuisances from animals, and from accumulations of manure.

In 1873, at Littleport. "Typhoid fever endemic." Water supply insufficient and in part polluted. Nuisances from cesspools, privies, and imperfect drainage. Accumulations of excrement.

In 1873, at Tottenham. Ill-designed cesspools in parts not sewered. Water supply contaminated with decaying animal refuse. Water-courses and ditches used as sewers. Large deposit of sewage mud at sewage works. Effusion of sewage on lower parts of village due to a flood. Escape of sewer air into the houses on the higher levels.

In 1873, at Moseley and Balsall Heath, 96 infected; 10 deaths. Porous soil extensively polluted by soakage from dumb wells, bad drains, and ash-pit privies. Wells supplying water for domestic use polluted with sewage or excremental matters. Typhoid fever broke out at a dairyman's; fever evacuations were here thrown into the privy; by soakage, excrement from this privy polluted two wells. Thence infection was borne *via* the milk to the customers. "Suds" in which infected clothing had been washed, afterwards polluted well water, from the use of which fresh outbreaks were traced.

In 1873, at Marylebone, 244 infected; 26 deaths. Due to infected milk supply, obtained from a farm near Chilton. The owner of this farm died of typhoid fever, his evacuations being buried, without disinfection, where they found their way into well water used for dairy purposes. Defects in sewerage and drainage were also discovered in the affected houses.

In 1873, at Combrooke (Warwickshire). Typhoid imported from Leamington, and spread to adjoining houses. The water much used in these houses was obtained from a well exposed to pollution. Privies in village imperfectly constructed.

In 1873, at Caius College (Cambridge), 15 infected (12 being in Tree Court). Excremental contamination of a particular section of the college water service.

In 1873, at Guisborough (Yorks). "Serious prevalence of typhoid." Water polluted from privy and refuse nuisances. Imperfect scavenging. Ill-built and overcrowded houses.

In 1874, at Baldock (Herts). "Outbreak of enteric fever." Polluted water. Air fouled by sewer emanations. Water-closets

without means of flushing. Accumulation of house refuse. Overcrowding.

In 1874, at Chippenham (Wilts). "Typhoid epidemic." Water supply inadequate and polluted. Numerous and very offensive cesspits. Sewers and drains leaky. Refuse heaps and pig-sties near to dwellings.

In 1874, at Godalming. "Constant prevalence of enteric fever." Wells close to cesspools. Imperfect sewerage. Excremental accumulations.

In 1874, at Truro. "Outbreak of typhoid." Entrance of foul air from sewers into dwellings. Water supply exposed to pollution. Defective sewerage. Insufficient privy accommodation and scavenging. Trade and pig-sty nuisances.

In 1875, at Chatteris (Cambridge). "High rate of mortality from fever." Privy pits in a porous soil and not water tight. Wells often close to privy pits, from which there is soakage into soil.

In 1874, at Auckland (Durham). "Extensive prevalence of enteric fever." Polluted water. Imperfect sewerage and drainage. Insufficient privy accommodation. Filth nuisances. Overcrowding.

In 1874, at Bourton-on-the-Water (Gloucester). Polluted water supply. Defective drainage. Privy nuisances.

In 1874, at Lewes (Sussex). Large epidemic of typhoid; due in first instance to pollution of town water supply by water drawn from the Ouse, which receives the town sewage, and spread by suction of polluting matter into the water pipes of an intermittent water service.

In 1874, at Over-Darwen (Lancashire). Large typhoid epidemic. Public water supply polluted by soakage and drain, into which excreta from enteric fever patient had passed, and in various other ways. River extensively polluted. Houses polluted by soakage from privies and cesspools. Gross neglect of scavenging. Accumulations of excrement. Sewerage system defective.

In 1874, at Lower Gornal (Staffordshire), 700 infected; 39 deaths. "Severe outbreak of enteric fever." Absence of drainage. Accumulations of excrement. Foul privies and surface nuisances everywhere. Polluted wells, with sewage containing the specific contagium and excremental matter. Unwholesome cottages.

In 1875, at Croyden (parish of), 1,200 infected; 90 deaths. Escape of infected air from sewers, and its inhalation by persons susceptible of the disease. The air of sewers was "laid on" to houses. No evidence of the well water having been a vehicle of infection. Opportunities exist for the passage of infection from sewers into small

confined cisterns and water pipes, but water pollution played a much less considerable part than sewer air infection in this epidemic.

In 1875, at Northampton Lunatic Asylum. "Extensive outbreak of typhoid." Its extension due apparently to the defective state of the drains of the asylum.

In 1875, at Royton (Lancashire). System of sewerage defective. Privies dilapidated and overfull. Soil and air polluted by overflowing cesspools. No system of scavenging. Enormous masses of excrement deposited in the neighborhood by the Carbon Fertilizing Company. Overcrowding.

In 1876, at Chalvey (Bucks). Cesspools and wells intermingle in porous soil. Hand-flushed closets, sinks, and stop-drains in connection with cesspools. Excremental fouling of air, earth, and water.

In 1876, at Eagley and Bolton. Simultaneous outbursts of enteric fever in Eagley and Bolton, in connection with the milk service of a particular dairy. Dairy water obtained from a brook, the course and banks of which had recently been largely fouled by human excrement. Sewerage, drainage, and water supply arrangements deficient.

In 1876, at Great Coggeshall (Essex). Epidemic of typhoid spread in first instance through the agency of an infected milk supply, and subsequently through the generally defective sanitary arrangements of the town.

In 1876, at Llanelly (Brecon). "Continued prevalence of typhoid. Epidemic of typhoid at Darenvellin." Insufficient privy accommodation. Absence of sewerage and drainage. Accumulation of refuse near dwellings. Water supplies generally exposed to contamination. Unwholesome method of excrement removal.

In 1876, at Royston Rural Sanitary Dist. "Large mortality from enteric fever." Water supply in many villages very deficient and very foul. Ill-constructed and ill-managed closets. Sewerage and drainage, when present, sources of nuisance. Dwelling accommodation dilapidated and filthy.

In 1876, at Tideswell (Derbyshire). "Outbreak of typhoid." Spread of disease favored by conditions in an intermitting water surface allowing suction of foul air into water pipes. Sewerage defective. Closet accommodation insufficient and a nuisance.

In 1877 (1873-77), at Ascot, 69 infected; 2 deaths. Epidemic of enteric fever lasting, with occasional intermissions, for four and one half years. Found to have invaded, almost exclusively, families supplied with milk from one particular dairy farm, and to have spread mainly by the use of that milk. Drainage arrangements at dairy bad.

Water used for cleaning milk cans, and for other dairy purposes, inevitably polluted by emanations from drains, which also polluted the atmosphere of the dairy. Well water contaminated from cesspools, privies, dung-heap, etc. Specific infection of milk was also possible.

In 1877, at Bedale (Yorks). Outbreak of enteric fever following importation to the town of a case of that disease. Wells generally liable to pollution. Nuisances from midden privies, and from keeping of animals. Deficient drainage.

In 1877, at Bradford (Wilts). Epidemic due to use of water subject to constant risk of excremental pollution. Nuisance from common privies. Absence of means of drainage in one part of the town.

In 1877, at Padstow (Cornwall). Specifically infected sewer air. Excremental accumulation and defective arrangements for its removal. Insufficient water supply, and wells exposed to contamination. Dwellings dilapidated and unwholesome. Sewers insufficiently ventilated.

In 1878, at Dewsbury District. "Epidemic of typhoid in first quarter of 1877." Midden privies a source of great nuisance. Urine stored about houses for trade purposes. Water supply subject to pollution; supply intermittent and liable to be fouled by suction of filth into mains. Sewerage and drainage deficient. Water supply in some cases from polluted wells.

In 1878, at Gomersal (in Dewsbury District). "Extensive epidemic of typhoid in 1873." Wells liable to pollution. Sewerage defective. Foul air passing from sewers into houses. Disposal of excrement and refuse very faulty.

In 1878, at Thornhill (in Dewsbury District). "Large mortality from typhoid." Defective and polluted water supply. Sewerage and drainage facilitating escape of foul air into dwellings. Grave nuisance from excrement disposal.

In 1878, at Soothill-Nether. "Very large mortality from typhoid." Causes as described under "Thornhill."

In 1879, at Chichester. "Outbreak of enteric fever." Due to infected milk (no contamination traced unless it were in the use of water taken from polluted stream for washing the cow's udders). Drainage mostly into cesspools, often very near drinking-wells. Branch of stream receiving sewage foul and stagnant.

In 1879, at Newquay (Cornwall). "Serious outbreak of typhoid." Faults of drainage. Use of well water polluted with sewage. Prevalence of nuisances.

In 1879, at Redhill and Caterham (Surrey), 352 infected; 21 deaths. Epidemic limited to the consumers of the Caterham Water-works Company's water. This water was contaminated by means of the evacuations of a man employed in the construction of an adit between two of the Company's deep wells, whilst suffering from an attack of unrecognized typhoid fever.

In 1879, at Selborne (Hants). "Outbreak of enteric fever," spread by polluted water and infected privies from an imported case of typhoid. Water supply from wells liable to pollution. Filthy privies. Excremental accumulations.

In 1879, at Wing (Bedfordshire). Epidemic of typhoid in a circumscribed area associated with the use of water from a well polluted by soakage from privies and drains. Excremental nuisances generally prevalent.

In 1880, at Aveley (Essex). "Outbreak of typhoid." Spread of fever due to sewage nuisances and polluted well water. Drainage entirely by cesspits, often in close proximity to houses. Well water exposed to excremental pollution. Scavenging neglected.

In 1880, at Blaby Sanitary District (Leicestershire). "Numerous outbreaks of typhoid." Due to drinking water from wells specifically polluted by soakage from infected privies. Also spread by infected atmosphere of privies and by milk. Accumulations of midden privy excrement. Wells exposed to pollution. Drainage either absent or defective.

In 1880, at Haverfordwest (Pembrokeshire). Origin of epidemic uncertain, but disease spread by sewer exhalations and polluted water. Sewers and drains faulty. Drain atmosphere escaping into houses. Ill-contrived water-closets indoors; offensive midden-steads close to houses. Excrement accumulation. Public water supply liable to contamination by sewer air. Water also obtained from polluted wells and streams. Nuisances from slaughter-houses and pig-keeping. Overcrowding.

In 1880, at Melton-Mowbray (Leicestershire). Due to infected sewer air. Unwholesome privies discharging into large and uncovered cess-pits. Water supply from wells exposed to pollution. Nuisance from pig-sties, slaughter-houses and refuse accumulations. Sewers defective and badly ventilated.

In 1880, at Millbrook (Cornwall). Epidemic due partly to infected sewers, partly to polluted water supply, and partly to contaminated milk supply from a house invaded by the fever. Entrance of sewer

air into wells. Public and private wells polluted by excremental soakage.

In 1880, at Newlyn-East (Cornwall). "A sudden, extensive and fatal outbreak of enteric fever in an utterly neglected and filthy mining village." Water supply scanty and mainly from a well with which the village drain freely communicates. Epidemic partly due to the use of the well water, partly to privies and collections of filth subsequently infected, and partly to distribution of milk from infected houses.

In 1880, at Pemberton and Orrell (Lancashire). Extensive outbreak of typhoid during drought after heavy rain, probably due to polluted spring water. Water supply from rain-water butts, or from springs and surface wells exposed to pollution.

In 1880, at Southend (Essex). Considerable epidemic of typhoid at Prittlewell, due to use of polluted water supply. Great want of drainage, and aggravated nuisances from cesspit privies in the village. At Southend, drainage incomplete. Sewer ventilation imperfect or absent.

In 1881, at Blackburn, 266 infected (from January to June); 24 deaths (up to April 16th). Due to contamination of water supply by soakage from drain conveying discharges of a fever patient at Guide on line of conduit. Sanitary administration good. Old midden privies being replaced by tub privies and water-closets. Excreta taken by canal to manure works. Sewage utilized for farm irrigation; other refuse destroyed in furnance.

In 1881, at Bodmin Urban Sanitary District. "Severe epidemic in 1881." Original source not traced. Sewers and drains badly constructed, leaky, and unventilated. Water supply partly from springs and wells exposed to sewage pollution. Reflux of foul matters from closet into public water supply possible. Nuisances from surface filth and pig-keeping.

In 1881, at Bridlington. "Sudden and extensive outbreak of typhoid." Especially affected houses supplied with milk from a particular dairy. Dairy well water polluted and possibly specifically infected. Some localities badly drained, with fever persisting. Nuisances from cesspools, defective house drains, and foul open water courses.

In 1881, at Hinckley (Leicester and Warwick). Water from wells in danger of pollution and liable to drought. Nuisances from bad drainage, privies, middens, and pig-sties.

In 1881, at Howden Rural Sanitary District (Yorks). "Outbreaks

of typhoid in different villages." Water supplies from shallow wells much exposed to excremental pollution. Streams polluted by privy contents. Specific pollution of school wells followed by outbreaks.

In 1881, at Ilkeston (Derbyshire). "Extensive epidemic." Due chiefly to infected sewer air escaping within and about dwellings. Groups of cases referable to infected privies and polluted water. Storage of excrement in large unwholesome privy pits. Half the town water supplied by wells sunk in a filth-sodden soil, and from tanks in direct communication with sewers. Deficient drainage.

In 1881, at Tawton (North Devon). "Limited epidemic due to specifically contaminated water." Water supply from wells and other sources, both exposed to dangerous pollution. Sewage discharged into water course. General excremental nuisance. Privies filthy and dilapidated. Bad drainage.

In 1881, at Tavistock Rural Sanitary District. "Typhoid endemic with occasional severe epidemic outbreaks." Drinking water often exposed to dangerous pollution. Excremental nuisances frequent. Sewerage and drainage defective.

In 1881, at Uckfield. "Outbreak of enteric fever." Wells sunk in soil befouled by soakage from privies, cesspools, ash-pits, and drains. Sewers unventilated. House drains unventilated and in connection with sewers.

In 1881, at Bangor and Bethesda, 548 infected; 42 deaths. The attacks limited to the consumers of water obtained from the Bangor water-works; case of typhoid at Llwyurhandir; excreta from this patient passed into the drain, thence to a small stream from which Bangor water supply is drawn, and thus to the filtering reservoir. Even if the filters could have arrested infective matter, many of the plugs were defective; fully one third of the water passing unfiltered into the water main. Cesspit privy at Llwyurhandir is below level of infected drain. Spread of disease promoted by connection between houses and ill-ventilated sewers, and filth accumulation near houses.

In 1882, at Galgate (Lancashire). Outbreak among persons drinking water obtained from a well contaminated with excremental matter. Insufficient water supply. Wells of doubtful purity. Midden privies a source of nuisance.

In 1882, at Millbrook (Cornwall). Same causes operating as caused the epidemic in 1880, q. v. "Renewed outbreak."

In 1882, at New Shoreham (Sussex). "Prevalence of enteric fever." Water drawn from polluted wells. House drains in communication with public sewers.

In 1882, at Norwood (Middlesex), 35 infected. Sudden dissemination of typhoid in fourteen dwellings supplied with water from the same well. Infected cesspool contents were deposited in a hole some forty feet from the particular well, upon higher ground, and in the line of natural soakage to the well. Intervening was a porous gravelly soil.

In 1882, at Southborough, 24 houses infected. Outbreak of typhoid in a circumscribed locality. Drains admitted of contents escaping into surrounding soil, and often of gas discharging into houses. Water entirely from local wells, often in close proximity to drains.

In 1882, at Ebbw Vale Urban District. "An almost house-to-house prevalence of typhoid in small detached hamlet in 1881." Due to excremental pollution of atmosphere from privy and other nuisances. Public water supply had failed, and inhabitants had largely resorted to questionable sources. Prevalence of sewage nuisances.

In 1882, Clapham (Surrey). "Outbreak of typhoid fever." Attacked (with one exception) only persons getting milk from a particular dealer at Clapham. Mode of milk infection unascertained, but there had been cases of fever some months before in the place (Axminster), whence it came, and the well water at the two milk farms there concerned was contaminated with sewage products.

In 1882, at Dartford Registration District. "Prevalence of enteric fever." In parts invaded the sub-soil water stands three or four feet only from the surface, and into this water level wells and cesspools are sunken indifferently. In the part of the town attacked, forty per cent of houses were supplied from local wells, and in these houses eighty per cent of the fever attacks occurred. Cesspool and other nuisances very common.

In 1882, at Ulverston (Lancashire). Considerable prevalence of typhoid in the autumn of 1881. Water mains water often so turbid that inhabitants resort to local supplies. Outbreak confined to users of a certain one of these local supplies. Insufficient sewer ventilation.

In 1883, at Hitchin (Herts), about 100 infected; 7 deaths. Public water supply liable to pollution by reflux of water from the river Hiz to the reservoir and pumping well. The river receives refuse water and sewage; and "it is impossible not to admit that, in all probability, there has been direct relation between the circumstances of pollution on the 30th December, 1882, of the public water service, and the outburst of fever in mid-January." Defects of public sewerage and private drainage.

In 1884, at Beverley, 231 infected; 12 deaths. Water supply chiefly from borings into the chalk which are occasionally polluted by direct percolation from a sewage-polluted soil. Water on analysis found highly charged with sewage matter. Sewerage antiquated and bad. Sewers unventilated, and having catch-pits at intervals to retain solids. Cesspools compulsory where water-closets are in use, being made in the course of the house drain before this latter enters the public sewer — the sewer thus receiving only the putrid outflow of the cesspool. Privy middens of large size uncovered, often connected with drains, and sunk below the surface level. Main feature of outbreak was specifically contaminated general water supply of Waterworks Company derived from deep well in chalk. Company's well and reservoir close to sewage-irrigated field belonging to East Riding County Lunatic Asylum, in which cases of typhoid had occurred antecedent to outbreak in Beverley. The outfall of the Asylum drains is into a settling tank in the corner of a seven acre field next to the Water Company's premises. Once a fortnight the settling tank is emptied by an intervening drain into an adjacent cesspit — this being simply an excavation in the clayey soil. It was not proved that soakage could occur from the cesspit to the well. Experiments negatived its possibility. Frequent chemical analyses of the Company's water during the epidemic repeatedly proved its purity and fitness for domestic use. Thus the method of contamination was probably the broad irrigation practiced on the field.

In 1884, at Colne (Lancashire). "Sharp epidemic of typhoid." Origin undiscovered. Drainage very bad. Sink pipes in untrapped connection with drains. Nuisances from ash-pits, refuse heaps, and cow-sheds. Pollution of river Colne. Water supply fairly pure.

In 1884, at Kidderminster. "Extensive outbreak of typhoid over the whole town." Public water supply in large part derived from an artesian well in dangerous proximity to sewage-pumping station. Intermittent water service — hence possibility of accidental contamination of water by foul matters sucked into pipes during intermissions. Arrangement of sewers favors the distribution of infected sewer air. House drains badly trapped, unventilated, and often in connection with interior of houses. Bad scavenging. Refuse accumulations; offensive trades. Outbreak owing either to inhalation of spray from sewage-polluted river water, or to drinking water of a well contaminated by soakage from the same.

In 1884, at Romford District. Outbreak of typhoid at Dagenham, due to drinking polluted well water, and to effluvia from foul ditch, in

1883 and 1884. At Ilford in 1882-3, due to infected milk supply and subsequently spread by sewage effluvia from cesspools and defective drains.

In 1884, at St. Albans, January, 2; February, 2; March, 4; April, 0; May, 93; June, 38; total for May and June, 131 infected; 23 deaths during May, June, and July. "Simultaneous outbreak of typhoid fever during June and July at St. Albans and London among the consumers of milk coming from a farm near St. Albans." Absence of evidence that the milk at the farm had become infected in any of the commonly-believed ways. Some reason for believing that this farm milk which had given rise to a serious outbreak of typhoid in St. Pancras in 1883, had retained, though to a slight degree, power of infecting its customers in the interval between the two outbreaks.

In 1884, at York, 315 infected; 54 deaths. Not due to water contamination. Milk supply exculpated. The outbreak was apparently due to exhalations from the sewers after an exceptionally dry, hot summer. Sewers unventilated; their outfalls covered by, and admitting backflow from, the River Ouse. Sink pipes generally disconnected from the drains.

In 1885, at Faldingworth and Barlings (Lincolnshire). Faldingworth: small outbreak of typhoid traceable to pump well water polluted by washings from a fever case imported from Newark. Filthy ditch sewers. Barlings: outbreak of typhoid traceable to pollution of the village water supply by sewage. House drainage defective. Vault closets in dangerous proximity to dwellings. Chief supply of water obtained by imperfect filtering of the sewage-polluted village brook.

In 1885, at Hebden Bridge. Outbreak of typhoid, affecting chiefly cottagers using excremental polluted water from the "Birchcliffe stone cisterns." Bad house drainage. Old open middens in dangerous relation to dwellings and open water courses. Springs used for domestic purposes in almost all cases open to pollution.

In 1885, at Kidderminster, 35 in second half of 1885. Cases existing in places where defective house drains existed — *vide* 1884.

In 1885, at Lower Sheringham (Norfolk). Severe outbreak of typhoid under circumstances pointing to contamination of milk supply. Origin of infection uncertain. Water supply from land drainage and rivulet in danger of pollution. Drainage defective. Nuisances from privy pits, net tanning, whelk boiling, and from ponded sewage, ordure, and fish offal.

In 1885, at Market Weighton (Yorks). "Prevalence of enteric

fever." Due to drinking water from surface wells in a porous soil, contaminated by soakage from defective sewers, cesspools, etc. Accumulation of excrement.

In 1885, at Newark. "Typhoid prevalent in 1884." An old and closely built town. Sewers mostly unventilated. Sewage discharged unpurified into the Trent. Company's water supply derived from gravel bed in the neighborhood of this river. Shallow wells also in use liable to contamination. House drains with loose iron traps, permitting escape of drain air into and near houses. Offensive midden privies. Refuse accumulations.

In 1886, at Swanage (Dorset). "Outbreak of enteric fever." First case in January; assumed an epidemic form from July to September. Water supply largely from impure wells. Drainage system consists almost entirely of square rubble sewers, many of them joining a highly polluted and almost stagnant brook. Large uncemented privy pits on and in permeable sedimentary rocks dipping steeply toward the town. No public scavenging beyond street sweeping. The epidemic associated at its commencement with the use of milk from a dairy situated on the polluted brook and without water supply on the premises.

In 1887, at Eastry Rural Sanitary District (Kent). "Mortality from typhoid sixteen per cent higher than elsewhere in England or Wales." Water supplies of most of the villages subject to pollution. Cesspits and privy pits in close proximity to dwellings and wells, polluting both air and water. No proper means of sewerage. Refuse and excrement accumulations.

In 1887, at Margate. "Increasing mortality from enteric fever." Deposit of sewage and excrement in deep cesspools and cesspits sunk into the chalk. Pollution of air and soil by excremental accumulations. Water supply pumped from a well in the chalk, beside a populous neighborhood. Water of bad quality and exposed to contamination by soakage of sea water and from cesspools. Water-closets getting water directly from mains.

In 1887, at Mountain Ash (Glamorganshire), 518 infected. "A sudden and severe epidemic of typhoid, 518 cases occurring between July and October, 1887." The specific poison was distributed by water delivered through one particular water main. Of the 396 houses supplied from this main below a certain point of its course 57 per cent were invaded by fever. Near this point (where evidence of specific contamination commenced) defects in the main were discovered, which would lead during intermissions of water supply to insuction of

air, and probably of liquid, from old drains. Earlier history shows that since the water main in question was laid in 1855, an endemic prevalence of typhoid has existed in the district supplied by it. Analysis of the water showed that a sample taken before the nightly intermission of service was pure; that taken from the same tap after intermission gave evidence of animal contamination and of the appearance of low forms of life. Sanitary conditions in other respects fair.

In 1888, at Buckingham. A sudden outbreak of typhoid in January and February, confined at first to a poor suburb of the town, and especially affecting persons drinking water from a particular "spout," the water conduit to this spout exposed to pollution from a leaky drain which had received specifically infected excreta from a previous case of typhoid. Scattered cases later on referable probably to infection derived from defective drains and foul closets. Water generally from wells exposed to risk of pollution by leakage from cesspools, drains, etc. Sewers and house drains very defective, allowing deposit, leakage, and entrance of drain air to houses. Old privies with large deep vaults; foul hopper closets.

In 1888, at Flint. Fourteen cases of typhoid fever in seven houses, between August 11th and 20th; subsequently general over the town. Water supply intermittent and discolored when turned on in the morning. Method of excrement disposal in infected locality such as to cause fæcal fouling of air and soil.

In 1888, at Keynsham Rural Sanitary District (Somerset and Gloucester). "Recurring prevalence of epidemic typhoid." Conveyed in the bodies of persons attacked from one part of district to another. Spread of the disease by specific excremental pollution of water. No proper sewerage provision. Cesspit privies in vogue. Water supplies exposed to dangerous pollution.

In 1887 and 1888, at Mytholmroyd (Yorks), 66 infected in 1887; 10 deaths. In 1888, 29 infected; 5 deaths. Prevalence of unwholesome condition of water supply, drainage, and excrement disposal. River Calder highly polluted with sewage and excremental matters, in fact little better than an open sewer. Twenty-two of the fifty-five houses attacked are situated in the immediate vicinity of this river, inhaling the effluvia arising therefrom. The local sources of water supply are from small streams descending the hillside. Washings from meadows and manured lands, and excremental filth pollute these streams. The water is conveyed in pipes from a spring on the hillside. This spring water is reinforced by sewage from a manure heap.

No system of sewage exists. Bad scavenging. Midden privies flowing over, etc.

In 1887-8, at New Brighton (Cheshire), 21 infected during 1887-8. "Typhoid fever prevalent." The fever prevalence had no relation to the water supply, nor to the milk supply. Faulty sewer ventilation. Drains are commonly carried beneath the floors of dwellings, without any special precautions. Gullies having unbroken communication with the drain, and so with the sewer, often exist in cellars. "The appearance of typhoid, at New Brighton has been found so constantly associated with specially grave defects of drainage, as to create a strong suspicion that this condition has been the cause of the mischief."

In 1887-8, at New Clee and Gt. Grimsby, 260 infected; 52 deaths. General water supply good. Some of the households drew their water supply from local wells, which were subject to risk of specific contamination. Some cases were due to the use of a box privy, into which the infected discharges of an earlier case had been thrown. More frequently, however, such discharges were thrown into the yard drain-inlets and catch-pits, and so infection of some of the smaller and defective drains occurred. Unventilated public sewers, along with faults of private drainage, led to ventilation of sewer air into private dwellings. "The pollution of wells by excremental matters must be considered to have played a part in the epidemic."

In 1888, at Stourbridge Rural Sanitary District (Staffordshire). "A severe outbreak of enteric fever in third quarter of 1888 in Pensnett and Bromley." Affected specially young adult males employed at ironworks, their chief beverage being ginger beer, made often at home from the water of polluted wells not wholly boiled. No sewerage; slop water nuisances prevalent; privies with wet open ash-pits; pig-keeping nuisances; wells exposed to pollution from these sources.

In 1888, at Standish-with-Langtree (Lancashire). "Prevalence of enteric fever." Ventilation of sewers obstructed. Midden privies drained into sewers causing nuisance. Water supply from local sources, one of them exposed to excremental pollution; incidence of fever chiefly in families using this supply, but spread of disease due also to privy defects. No system of scavenging. Prevalence of nuisances from undrained yards and from pig-keeping.

DIPHTHERIA.

The mortality returns made to the registrar of vital statistics as well as the monthly returns made to this Board, show that diphtheria is a disease that every year destroys the lives of many children in New Hampshire. The fearful results of this horrible malady, in the magnitude that it prevails, are, in the light of modern sanitary science, uncalled for, and indicate mismanagement of the disease with respect to isolation and disinfection. It is a pretty well settled fact that diphtheria is a germ disease; that the germ is easily transported, and propagated, under suitable conditions; that unless the conditions are favorable the germ loses its vitality and becomes harmless. It is therefore an infectious and contagious disease. Evidences of direct infection from an existing case are common. Because persons exposed to the disease do not always contract it, is no proof to the contrary. We have seen the disease spread from person to person and from family to family with fearful and terrible consequences, simply because reasonable and proper measures were not taken to prevent it. That it can be restricted and prevented has been often demonstrated whenever sanitary and restrictive measures have been thoroughly attended to and enforced.

Nothing favors the ravages of this disease so much as filth, in some form or other; and with neglected sink-drains, foul privies, undrained cellars, wet sites, unventilated rooms without sunlight, polluted drinking water, and many other unsanitary surroundings, a liability to an outbreak is greatly increased, and treatment of the disease under such circumstances is often of little avail in saving life. Therefore, first of all, every family should see that the premises are clean and free from such conditions as invite its appearance to the household.

There is some doubt that bad sanitary conditions develop this disease *de novo*, but there is no doubt that filth is a condition *par excellence* for the culture and propagation of the infection. Unsanitary environments also weaken the powers of resistance against this and other diseases.

There are various ways in which the disease is spread. There are on record fourteen epidemics of this disease caused by milk. In only one of the epidemics was the disease found in human beings at the dairy prior to its outbreak among the customers and the dairy hands simultaneously. In five instances exceedingly bad sanitary conditions were found at the farm and in close relation with the milk. It was believed that the specific germ got into the milk and there developed in such abundance as to infect the consumers. Instances are on record where the disease has been transmitted by cats and other domestic animals, they sometimes becoming infected with diphtheria or act as a carrier of the disease. The Connecticut Board of Health Report, for 1889, cites a case conveyed by clothing, and a second case from a nurse probably through clothing; by one child chewing gum which a convalescent child had been chewing; by a case mistaken for mumps; by contact with children convalescent two or three weeks after recovery; by inhabiting tenements where the disease had been, without proper disinfection; books used by children during convalescence are supposed to be the purveyors of the disease to other families.

The direct transmission of the disease from the infected to the well is of common occurrence, and cannot be doubted by any one who has had much experience with this disease.

Public funerals of persons dead of this disease have sometimes been the cause of an outbreak of diphtheria. Indeed such results have been frequently reported. Dr. Henry B. Baker, secretary of the state board of health, of Michigan, in a recent report says:

"In March, 1890, two corpses, woman and child of same family, dead of throat disease, were conveyed from Montmorency county to Lapeer county, Michigan, where just one week from the day the coffins were opened and the remains were viewed, a person who was thus exposed came down with diphtheria. Many others would probably have been exposed except for the action of the local health officer, Dr. C. A. Wisner, who, suspecting that the cause of the death was

diphtheria, warned the neighbors and forbade the opening of the coffins at the funeral. He promptly isolated the first case that occurred, and no epidemic resulted. This is quite different from the result of a similar occurrence in Zanesville, Ohio, last spring, where many deaths resulted from exposure to a corpse brought from Chicago."

At the last meeting of the American Public Health Association the committee on the "Cause and Prevention of Diphtheria," made a report based upon the most recent scientific investigation and special reports from various parts of America upon several hundred cases of the disease. Referring in a general way to the disease the committee says:

"For some cause, the public, including medical practitioners, has grown apathetic and hopeless in regard to the prevention of diphtheria to a degree not experienced toward any other disease. There is a submission to a yearly sickness, from this cause, of not less than forty thousand cases in the United States and Canada, with an annual death loss of at least ten thousand lives; and this, with little demonstration of organized resistance. This condition probably has come from the observed limitations of curative agencies, and from the want of satisfactory demonstration that preventive measures can be adopted and made effective. Then, too, with the wide distribution of cases, and constant presence of the disease in almost all of our large communities, together with the knowledge that where one case is detected, dozens escape detection, has this feeling of hopelessness become established.

"Can any one doubt that a similar number of cases and deaths from cholera, yellow-fever, or other of the rapidly spreading epidemic diseases, would arouse us to utmost effort to limit and stamp out the destroyer? Yet it is from those diseases, which prevail so constantly that we are not surprised by them, that our greatest losses occur, and the lives thus lost are made to appear as being regarded of less value than those lost by sweeping epidemics, for whose suppression or prevention money and effort are expended without stint. No doubt this state of the public mind in respect to diphtheria could be

dispelled, and replaced by one of energetic resistance and hope, could this Association, or any other body of competent investigators and leaders, be able to demonstrate specified causes or sources of this disease, which could be resisted and overcome by disinfection, inoculation, isolation, or by any other method compatible with the well-being of those unaffected. Unless this can be done and confidence infused into preventive measures, this disease remains a constant reproach to sanitary science, and the public falls further into submissive inaction."

Isolation and disinfection are the recognized means by which diphtheria may be suppressed. All sanitary authorities agree to this, but the obstacles that stand in the way of effectually putting these forces into operation are great, and will remain so until the public mind becomes better informed upon these points. Alluding to these questions the committee in the report mentioned say that—

"Scientific isolation of recognized cases of diphtheria is rarely, if ever, secured in private homes. Disinfection of bedding, clothing, and all articles coming in direct contact with the sick, or closely associated with them, require special methods and apparatus to be made reliable. Therefore, whether hospitals for compulsory treatment can wisely be instituted or not, disinfection stations can and should be erected and operated at the public expense. The value and duration of isolation can be determined only when made scientifically complete. The same is true of disinfection."

Dr. Arthur Hazlewood in discussing this subject before a sanitary convention in Michigan says:

"What shall we do to be saved from diphtheria? I answer in three words, prevent, isolate, disinfect. Under the first head—I have great faith in the resisting power of a healthy constitution. Our bodies have the power to destroy, to some extent, the disease germs coming in contact with them, but to do this effectually a vigorous state of health is needed; also, freedom from cuts, sores, or other breaks in the skin or mucous membrane. This condition of health we maintain by

proper care of our persons and surroundings; by temperance in all things — eating, drinking, smoking, dancing, or other forms of dissipation; by taking sufficient sleep; by daily bathing in tepid water; by out-door exercise suited to the strength of the individual; in short, to render our bodies able to resist disease, just as a military fortress well built, guarded, and manned, is able to resist attacks of outside foes.

"But when the disease attacks us and finds a lodgment, are we to allow it to have its own way and strike down one after another of our dearest and nearest according as it listeth? A thousand times no! Forewarned is forearmed. We do know how to prevent its spread, we do know how to destroy its action, at least beyond the first victim, but, unless we do our best, we can blame no one but ourselves for the mishaps."

But we continue from the excellent report of the committee of the American Public Health Association quoting extensively from its general discussion of the disease and giving its detailed suggestions *in toto:*

"It is the generally accepted belief that diphtheria is dependent upon a specific germ. Less than one half believe this specific cause is developed in other than albuminoid substances, and almost an equal number consider the question of its development still unsettled. Over one half believe that the specific cause is preserved in other than albuminoid substances.

"Air, water, and food are the media by which the virus gains entrance to the organism, and the air passages, mouth, and throat are the channels; occasional cases arise from inoculation through carelessness or uncleanness.

"A great variety of conditions increase individual susceptibility. They prevail in frequency in the order named, — nasal and pharyngeal catarrh, debility from any cause, age, etc.

"Many consider the disease much more fatal in scrofulous children with light hair and eyes, than in those having dark skin, hair, and eyes.

"The general opinion prevails that the disease is never caused by any agent developed within the body, but is always from without. All but a very small per cent consider that those affected with diphtheria should be carefully isolated, at least until all traces of the disease have disappeared, while many would isolate from one to eight weeks after recovery.

"Sulphur, mercuric bichloride, heat, carbolic acid, and pure air, in the order named, are the substances considered most reliable for disinfection. Sulphur in the form of sulphurous acid made by burning sulphur in the presence of moisture, mercuric bichloride and carbolic acid in solution, free ventilation, heat in form of steam, boiling water, and dry heat are the methods by which these substances should be used.

"Only a small per cent consider disinfectants sufficiently reliable to make it safe to do away with isolation entirely, although many think the time of isolation may be safely shortened where thorough disinfection is used.

"A very large per cent believe public health demands the maintenance of hospitals for isolation and treatment of those affected with diphtheria. More especially are such hospitals needed in the crowded portions of cities, and among the poor where proper care cannot be afforded. Such hospitals would also be of great service where the disease has become epidemic, and would enable the sanitary officers to stamp out the disease.

"There are no climatic limitations known as affecting either the development or the spread of diphtheria. It has been found to be most prevalent in the cold, damp months of the late fall and early spring, but catarrhal affections also prevail more at that season, and diphtheria may find easier access to the human system because of the already diseased membranes.

"Domestic animals and fowls are believed by the majority of observers to be liable to the disease. Many of those answering the question have themselves observed cases of diphtheria in dogs, cats, and the common barnyard fowls, and have

traced cases in human beings to these animals. They may also be the media by which germs of the disease are carried from person to person, or from house to house, the fur of the dog and cat being an excellent vehicle for conveying the virus. The investigations of Bretonneau, Trousseau, Virchow, Oertel, Mackenzie, Klebs, Wood, Formad, Sternberg, Loeffler, Prudden, Northrup, Koch, and many others of recent times, in and by strictly scientific methods, have led up to and perhaps have demonstrated a specific cause for diphtheria, and their conclusions, spread through the writings of the last thirty or forty years, cannot fail to have made an impression on all students. Yet the fact remains, that so much difficulty has been experienced in reconciling the facts observed in this field of disease with the conclusions of these students in laboratories and hospitals as to beget a very conservative and even doubting state of mind among thoughtful observers, on many of the points presented. As a practical question in preventive medicine, the determination of cause or causes is imperative,—the basis of all action. The more early, precise, and exhaustive such determination can be made, the more direct and hopeful the application of preventive measures.

"It cannot truthfully be said that no advance has been made, in this matter, in late years. On the contrary, in the whole field of research in respect to the micro-organisms found actively associated with various diseases, most pains-taking and exhaustive processes have been applied to the discovery, classification, and life history of each and every species, with great additions to our knowledge of the subject. Perhaps the most important point developed in this field, in most recent times, has been the significance attaching to the *products* of these organisms, during their process of development and activity, under favorable conditions. Such products appear to bear a very causal relation to the phenomena of many diseases, and also have been observed to limit the action and life of the producing organism, when sufficiently concentrated. On another side of this subject, it has been made safe to say that

not only has every living organism a certain natural and, in a measure, selective habitat, nutriment, method of reproduction, and tolerance of variation from its norm, but also has its own special defences against other organisms. And while an attack may be overwhelming mechanically, or, by reason of numbers simply, overcome such normal resistance, there can be no other logical conclusion than that the general or special resistance of one organism toward another can be increased or diminished. A part of such resistance, by the human organism, has been observed to be a process of reception and destruction of certain micro-organisms, by cell and gland action, resembling a form of digestion. To secure and retain such resisting cell and gland functions, together with integrity of tissues, the human organism must be in no defective state. The impairment of disease resistance may and does come from so many varying causes and channels, and is so difficult of recognition and estimation of its significance, as to be still restricted to general terms in description, and only of general application in preventive efforts. And although admitted to be 'general,' as indicated, no process of reasoning can or should lessen the force of the universal law, that well organized, developed, and nourished living structures resist the entrance of all external agents calculated to injure or destroy them better and longer than those of inferior organization, imperfectly developed and poorly nourished.

"On the question of specificity in diphtheria, the recent work of Roux and Yersin in France and Loeffler in Germany gives, perhaps, the index and conclusion to bacteriological work in this field up to the present day.

"For the purpose of giving such work its proper recognition and value, and at the same time giving opportunity to compare their conclusions with the result of observations of the course and spread of the disease in this country, extracts are here cited. In the 'Annals of the Pasteur Institute' MM. Roux and Yersin state it as their opinion that the Klebs-Loeffler bacillus is so specifically identified as a cause of

diphtheria as to render it necessary that all practicing physicians should be able to isolate and identify this bacillus.

"They themselves have made or verified the diagnoses of diphtheria by this method in more than a hundred cases, and they think that not until diagnoses are made in this way will thoroughly scientific results be obtained. In order to stain the bacillus so that it can readily be seen and studied under the microscope, it is merely necessary to move a small fragment of the false membrane, by means of a piece of absorbent cotton-wool tied firmly to a pair of forceps, or any other safe carrier, from which it is transferred to a scrap of blotting-paper, and thence to a cover glass, where it is broken down as finely as possible, heated over a flame, and stained methyl blue or gentian violet, washing thoroughly with water before examining.

"They say that the diphtheria bacillus appears to 'stain' more rapidly and deeply than any of the indifferent organisms associated, and among which they can be seen grouped in small masses as short, straight or curved rods with slightly thinned or rounded ends. In some instances they appear slightly clubbed or pear shaped; and they may be granular and unequally stained. They assert that, in true diphtheria, these bacilli are never absent, and with a little practice it is easy to distinguish them from all other forms. This examination may be completed in a few minutes, and gives, when confirmed by culture experiments, the most precise information. Even the course and prognosis of the disease may be followed and indicated by the daily use of the microscope upon the exudate and secretions. Where improvement is taking place the specific bacilli become less numerous, while other associated microbes become increased in number. These writers assert that some of the associated microbes appear to interfere with the growth and activity of the specific bacillus. These bacilli retain their vitality, when dried, for a considerable time, and withstand a temperature of 98 degrees C. (208 degrees F.) for a whole hour. As a very obvious point in practical application Roux and Yersin,

together with Loeffler and many others, state that 'the best method of arresting the spread of diphtheria is to recognize the disease as early as possible. This can be done by microscopic examination, confirmed by cultivations on blood serum, both of which can be made available in twenty-four hours in private practice and by ordinary practitioners of medicine. Active diphtheritic virus can remain in the mouth of the affected for a long time after the malady is apparently cured. Consequently diphtheritic patients should be allowed to resume their ordinary course of life only when they are no longer bearers of the bacillus. The virus retains its vitality a long time when kept in a dried state and when not freely exposed to air, and it is therefore necessary to disinfect, in a steam sterilizing apparatus, the linen and all articles that have been in contact with diphtheritic patients. The attenuated virus of diphtheria is widely distributed, and readily regains its virulence under favorable conditions. It is therefore necessary that at the commencement of simple forms of sore throat, antiseptics should be applied carefully and thoroughly.' Klein and some others maintain that domestic animals, including cats, dogs, cows, and some fowls, are affected with the true diphtheritic virus, while Loeffler and others regard the disease to which such animals and fowls are subject as a separate and distinct disease. Experiments appear to demonstrate, however, that certain animals, such as guinea pigs, rabbits, young dogs, etc., are easily susceptible to the true diphtheritic bacillus.

"In conclusion, and for the purpose of exerting some influence upon public opinion respecting the cause and prevention of diphtheria, your committee would respectfully offer the following propositions to the Association, which they hope may be adopted:

"*First.* We recognize the disease known as diphtheria to be due to a specific cause, owing to which all cases become dangerous as sources of contagion and infection.

"*Second.* For the prevention of diphtheria, isolation of those affected and infected should be made scientifically com-

plete in all cases; and we believe that by such isolation of all recognized cases the spread can be immediately checked.

"*Third.* That while it may not be possible to secure prompt recognition and isolation of all cases of diphtheria in the present state of knowledge and opinion, we believe it the duty of local boards of health and health officials to provide stations, apparatus, and agents for the reliable disinfection of all bedding, clothing, and articles which may be the holders and carriers of diphtheritic virus, such disinfection to be done at the public expense and under official control.

"DETAILED SUGGESTIONS FOR THE APPLICATION OF EFFICIENT MEANS FOR CLEANSING AND DISINFECTING CLOTHING, FURNITURE, AND PREMISES WHICH HAVE BEEN EXPOSED TO THE INFECTION OF DIPHTHERIA.

"DISINFECTION OF CLOTHING BY HEAT.

"All infected articles of clothing before handling or moving should be moistened with a watery solution of carbolic acid, or even water alone, to prevent germs of the disease passing into the air and thus becoming disseminated, and also to protect those engaged in the work of disinfection.

"All small and inexpensive articles and cloths, which can be spared without serious inconvenience should be destroyed at once by burning. Other articles of clothing, bedding, carpets, rugs, and all textile fabrics should be placed in sufficient water to cover them and *boiled* fully one hour.

"Mattresses and 'ticks' should be ripped open, the covers boiled and the contents replaced if unsoiled. If the contents have been soiled, they should be destroyed. Carpets should be ripped into separate breadths and boiled. After boiling as indicated, all such goods should be hung in the open air and sunlight for two or more days. 'Ironing' all such goods while moist, with an 'iron' kept as hot as the goods will bear without scorching, develops steam under some pressure, and will disinfect in a measure, but will not

take the place of prolonged boiling. 'Steam' under a pressure of twenty-five pounds to the square inch will take the place of boiling, where it can be applied.

"'Dry heat,' applied in chambers for the purpose, and in which the goods are heated in all portions to a temperature of 230 degrees F. for one hour, will serve the purpose where boiling and steam under pressure cannot be used.

"DISINFECTION OF CLOTHING BY CHEMICAL AGENTS.

"No. 1. A solution of carbolic acid prepared by placing three teaspoonfuls of the acid to each quart of water used (and thoroughly shaken); or

"No. 2. A solution of 'corrosive sublimate' prepared by dissolving two drams of the crystals in each gallon of water used; or

"No. 3. A solution of chloride of zinc prepared by dissolving two ounces of the crystals to each gallon of water used; —

"Into either of which solutions the goods and fabrics should be placed, and kept under water for twenty-four hours.

"*Sulphur gas*, produced by burning two pounds of sulphur for every one thousand cubic feet of space, with sufficient steam escaping in the room to moisten the air and surfaces, is a powerful disinfectant; but such gas in a tight chamber, in the presence of sufficient moisture to be effective, will injure and destroy clothing.

"Any of the chemical agents require caution in their use, as, taken internally, they become dangerous to life.

"DISINFECTION OF FURNITURE.

"This includes the bedsteads, chairs, vessels, and dishes, and all upholstered and movable articles. These should be washed in the solution No. 1 (carbolic acid) prescribed for clothing, with thorough sponging of the upholstered portions.

"After washing and sponging, the bedsteads, chairs, and all articles chiefly of wood should be allowed to stand, without wiping or rinsing, in the open air for twenty-four hours or more. All earthen, tin, or iron vessels, dishes, or utensils

should be first washed in the solution, and then placed in an oven or other chamber and heated to as high a degree as they will bear without injury. After this treatment, all such furniture should be thoroughly rinsed, and the rinsing water carefully saved and boiled for one hour before being thrown upon the ground or into sewers or drains.

"DISINFECTION OF PREMISES.

"The room or rooms should be tightly closed, after clothing and furniture (as indicated before) have been removed, and all metallic surfaces, such as gas fixtures, mouldings, etc., coated with an ointment made of carbolic acid one part, vaseline fifteen parts. Then sulphur should be burned in the rooms at the rate of two pounds to one thousand cubic feet of air space, with steam enough thoroughly to moisten the air and surfaces. Steam sufficient can be developed by placing three or four hot bricks in a tub of water. The sulphur gas should be kept in the room for twenty-four hours. After thus fumigating the rooms, the floors, baseboards, doors and casings, and every portion of woodwork should be washed with solution No. 2, prescribed for clothing. The walls and ceiling, if papered, should be carefully scraped, and the fragments immediately burned. Then the walls should be thoroughly coated with a quicklime wash, and the outer air and sunlight be permitted to enter freely for one or more days. In cases where expensive papers are on infected rooms, a coating of light varnish may replace the work of removing the paper.

"Diligent search should be made for any inlet into the building which may convey or permit the entrance of air from any sewer, drain, closed cellar or basement, or damp, dark place of any kind under the building or connected to it in any way. If any such inlet is found, or any such place where air is confined, such inlet should be properly closed, and any damp, dark place underneath the building opened up to air and sunlight; and in addition, all such drains and places should be disinfected by a solution of the chloride of lime, two ounces to

the gallon of water. Sulphur may be burned in such places as prescribed for rooms.

"Outside the building all pools of either rain, soil, or slop water near the building should be abated by draining and filling. An excessive soil saturation and retention of water should be relieved by draining. Any accumulation of garbage, decomposing animal or vegetable substances, muck, or dust, should be carted away and burned.

"Also the contents of cesspools, vaults, pits, and ash heaps, where refuse matters have been thrown, should be carted away, and all such places made sweet and clean. These places can be disinfected by the use of chloride of lime in solution as prescribed, or, in moist places, by sprinkling the lime over the surfaces. All dark, damp pits, vaults, drains, rooms, spaces under the building or near it, should be freely opened to the outer air, thoroughly cleaned, and kept so.

"The care and treatment of persons sick with diphtheria, both at the time of their sickness and for some time after all signs of the disease have disappeared, are of the utmost importance to promote recovery and diminish the work of disinfection.

"A constant use of substances known to be destructive to the bacillus and virus of diphtheria during the course of the disease, by washes, gargles, and spray with steam upon the diseased surfaces, prevents the escape of the virus to surrounding objects. The complete isolation of the affected, the removal of all unnecessary articles of clothing and furniture from the sick room, the prompt attention to and destruction of all secretions and excretions expelled, the free admission of sunlight and pure air to the sick room will diminish the extent and labor of disinfection.

"The duration of isolation of persons affected with diphtheria should extend so long as any of the bacilli are present in the secretions; and as this fact cannot be determined without repeated, skilful, microscopic examinations, the affected individuals should be kept strictly isolated for not less than four weeks after the disappearance of all traces of membrane."

In addition to the suggestions embodied in the foregoing report we desire to emphasize in the strongest possible way the importance of *thorough isolation and disinfection*. Without it there is no certainty of controlling the disease. We believe that if every case of diphtheria could be as effectually taken care of as is customary in cases of small-pox, the ravages of the disease would be exceedingly limited. Much of the so called isolation is only a pretense and disinfection as very commonly practised is a useless farce. Either to be effectual must be *complete*.

Dr. Hazlewood, before quoted, in further treating this subject truly says:

"How are these magic wands — *isolation* and *disinfection* to be obtained and applied? By having an effective health officer paid a salary by the citizens just as you pay a chief of police or fire department, whose duty it shall be to ascertain removable causes of disease, and whose authority in such matters shall be recognized equal to any officer of your corporation.

"The efficiency of the health officer should be determined, not by the number of outbreaks speedily and effectively ended, but by the absence of disease or as some would say, by the office being a sinecure. In towns and villages such officers are not needed to expend their whole time in the duties mentioned, and in some instances perhaps are not appointed — whenever fire is called, all take part in one way or another in overcoming it. But with this disease as well as other contagious diseases, the trouble may be wide-spread before discovery. The annual cost of an efficient fire department in a city of moderate size is about as many dollars as there are units in population, and the police department equally as much; yet, where will you find a like sum appropriated for health purposes? Are the lives of people of less money value than the destructible property belonging to them?"

Every town in the State should have an able, active, and efficient health officer ever ready to perform thoroughly, promptly, and impartially the duties and obligations of the

office. His position should be recognized by the people as second to none in its capacity to protect and benefit the public.

In every case of diphtheria he should enforce isolation, and disinfection should be carried out under his personal supervision, or by some competent person authorized by him. He should qualify himself, if not already competent, to instruct the public upon all the points so essential to the suppression of this as well as other preventable diseases. We repeat that isolation and disinfection are the only agencies that can control this disease with certainty.

HYDROPHOBIA.

Several cases of hydrophobia in the dog have been reported during the year. The action of the last Legislature in establishing a license upon dogs, provided also that the Secretary of the State Board of Health should furnish a description of the symptons of this disease to be printed upon the blank form of license. In conformity to this law the secretary furnished the following, upon the authority of "Williams' Principles and Practice of Veterinary Medicine," which was printed upon the license blank furnished by the Secretary of the Board of Agriculture:

SYMPTOMS OF HYDROPHOBIA IN THE DOG.

There are no premonitory symptoms — such as pain in the seat of the bite, melancholy and irritability, febrile disturbance, and stiffness about the head and neck. The dog, when the period of latency is passed, becomes restless, dull, watchful, withdraws from its companions, choosing solitude, shunning the light; hiding in corners, or below chairs or other furniture; being fidgety, lying down, then jumping up again in an excited, unnatural manner; it has a tendency to rove about, and if possible to escape from its room or kennel, and wander about the country. At first the dog's power of recognizing people about it does not seem lost; indeed there are moments when the usual faculties of the dog, its affection and liveliness, seem greater than usual. There is a desire to lick anything cold, to rest the nose on a cold object, and to pick up stones, bits of wood, straw, etc. At

this stage the tendency to bite is not observed, but as the disease advances the movements of the animal become unsteady; the eyes follow objects in a peculiarly staring manner; sometimes the dog will stare at some imaginary object, then rush forward, and bite at anything that may chance to be in his way, or even at the air, as if he were catching flies; cushions, straw, and other objects by which dogs are ordinarily surrounded, are tossed about; the animal scratches the ground, snuffles as if on the scent; the appetite is lost, but the thirst is considerable, and the *act of drinking* is performed *without much difficulty* during the early stages of the disease. At a later stage, however, swallowing is performed with difficulty, or is not performed at all, owing to the spasmodic constriction of the throat; but even then the animal has no dread of water, does not shrink at the sight of fluids, but, on the contrary, will plunge its muzzle deeply into it, and endeavor to drink with great avidity. The coat is staring, the skin tight on the ribs, and the belly tucked up. The dog occasionally vomits, the ejected matter being tinged with blood; there is a brownish coating on the tongue; the nose and mouth are foul and offensive, and there is generally a flow of saliva from the mouth.

The mad dog, or a rabid animal of any kind, brought into the presence of one of the canine species, exhibits great excitement, exasperation, and fury, with a desire to attack and destroy what seems the object of its hatred. The females of the canine species do not always lose their maternal affection; on the contrary the young are attended to with great affection. In the course of a day or two after the first manifestations of the above symptoms, the characteristic signs become more marked; the desire to bite is greatly exaggerated; the pupil dilated; the conjunctivae is red and injected; the eyes are alternately wide open with fury, and then closed in a dull but fierce manner. The forehead becomes wrinkled, and the looks of the animal are terrifying and repulsive; the presence of a living object excites the rage of the sufferer, causing it to spring at and endeavor to bite it. Any shining object will bring on a paroxysm of rage or excitement, and water, if the light shines upon it, will do the same; but if placed in a dark place, or where light does not shine, the dog will endeavor to drink with avidity. Intermitting with the excitement are periods of great prostration, the exhausted animal lying down in the quietest spot it can find, insensible to all surrounding objects. All at once, however, it springs up, and becomes greatly agitated; the excitement, rage, and agitation being always much greater when

the animal is surrounded by noises and objects; when away from these things, in a quiet place, the fits of rage are not so great, sometimes scarcely observable.

The bark of the rabid animal is unnatural; it is husky, spasmodic, and more of the nature of a howl. In some cases, the nervous symptoms are those characterizing paralysis of the jaw, with inability to close the mouth; the lower jaw is dropped, the cavity of the mouth and its contents exposed, the tongue dry, and the buccal membrane of a brownish hue. This is the "*dumb madness*," thus called because the animal is unable to bark or howl. Rabid dogs have a tendency to eat filth; they have been known to eat portions of dead dogs, and to swallow hair, coals, earth, excreta of all kinds, and these remaining in the stomach present a characteristic *post mortem* appearance. A mad dog, when loose, will travel an immense distance in a short time, generally rushing at everything that comes in its way, but preferring to attack other creatures than man, and finally endeavoring to return home, as if prompted by some instinct. The pulse is said not to be accelerated, nor are the respiratory movements much increased, except during the paroxysms; the bowels are constipated, and the urine is high-colored; the gait is unsteady, the tail droops, the head is depressed, the nose protruded; the fits of rage become shorter, those of depression longer; sight, scent, and hearing are much impaired; insensibility to pain, which is generally present from the earliest stages, is more and more manifest; and finally paralysis, particularly of the hind limbs, supervenes, and if not destroyed, the dog dies, an emaciated, repulsive object, the desire to bite remaining to the last. In the dumb form the ability to bite is lost, as well as the power to lap fluids. The exposed and protruded tongue is covered with a stringy, tenacious saliva; the desire to drink is even more intense than in the furious form, and attempts to lap and swallow become painful to witness. Squinting of one or both eyes has been observed; there are also abdominal pains in some instances, and an inflamed condition of the nasal cavities, larynx, and bronchial tubes. There is no tendency to harm and bite surrounding objects, and the dog dies from coma, exhaustion, and suffocation. Both forms of the disease terminate in death in from four to eight days. It is, however, reported that some chronic cases of rabies exist for an indefinite period.

The dread of water — hydrophobia — which has been looked upon by some as the diagnostic sympton of the disease, is absent in the dog. The desire for water is always excessive; there is inability to

swallow fluids, hence a dog will plunge his nose deeply into water, lap it with avidity, but owing to the thirst being still unallayed, he will become greatly agitated, and is thus often thrown into a state of fury or of involuntary spasms.

SOME OBSERVATIONS UPON THE CAUSES OF DEATH IN NEW HAMPSHIRE.

An accurate record of the causes of death constitutes the only guide or measure by which the results of sanitary work can be definitely determined; it also as effectually points out those localities to which the attention of the health officer should be turned for active work to lessen an abnormally large death-rate. Were it possible to secure the return of every case of illness that appears in the State we would have an absolutely correct criterion upon which to base all calculations respecting sanitary work. Such a record, however, under the present conditions of social, moral, and legal government is not attainable, therefore, the next best information, which thanks to the progressive spirit of the people of the State we are in the possession of, is a reliable and approximately correct record of deaths. We would be more fortunate if this record covered a longer period. It is only within the past seven years that the death returns have been sufficiently accurate for making deductions respecting the prevalence of certain diseases, yet the facts that have been established from the mortality records of this brief period are invaluable from a public health standpoint, not to mention the importance of the individual records in matters pertaining to person and property.

In the following pages will be found a brief summary of the causes of death, with comments necessary to a better understanding of the tables presented. Those desiring to study this subject more in detail should consult the registration reports. In these reports will be found the mortality record of every town in the State.

The total number of deaths returned to the registrar of vital statistics for the year ending Dec. 31, 1890, was 7,368. This is the largest number of deaths ever returned in a single year, being 672 more than was returned in 1889, and 766 more than the average for the past seven years. The largest number heretofore reported, was 6,854 in 1888.

Before going further it may be well to anticipate briefly some of the facts that will be revealed further on concerning the large increase in the mortality returns of the year 1890. The increase of 672 over the returns of the previous year can be accounted for only to a very slight extent by greater accuracy in the registration of deaths; but must be due to other causes — in fact, chiefly to one cause, the epidemic of influenza. An examination of the returns shows that the increased mortality is confined almost entirely to three classes, constitutional, local, and developmental diseases, there being a decrease in the deaths from zymotic diseases. As an index to the prevalence of influenza it may be noted that 94 deaths were attributed to this cause alone, as against four for the previous year. In addition to this, influenza, or "*la grippe*," is mentioned as a complication in very many other cases, more noticeably in the diseases of the respiratory system. The mortality from pneumonia was 121 greater than in 1889, acute bronchitis was nearly double that of the previous year, and in a like manner its influence is apparent in many other diseases. Of course it is impossible to state, even approximately, the number of deaths indirectly caused by this epidemic, but that it should have been so important a factor in increasing the death-rate of the State was not, perhaps, expected and would not have been revealed except through the registration of deaths. The particular diseases, or causes of death, which have been apparently increased through this cause are more clearly shown by the tables given in the registration report for the year 1890, as well as in some of the tables herewith presented. In the following table is given the number of deaths in each year from 1884 to 1890, inclusive, with percentage to each 1,000 of the population.

TABLE No. 1.

Deaths and Death-rates from 1884 *to* 1890, *inclusive.*

YEARS.	Deaths registered.	Deaths to 1,000 of population.*
1884	6,194	17.26
1885	6,201	17.13
1886	6,426	17.61
1887	6,479	17.61
1888	6,854	18.48
1889	6,696	17.91
1890	7,368	19.56
Average	6,602	17.94

* Population estimated for all but census years.

The returns for the six years prior to 1890 are very uniform, and but for the epidemic of influenza we have reason to believe that the figures for the latter year would very closely approximate those of the preceding years. We believe that these returns are very nearly correct — indeed as near absolute correctness as it is possible to obtain under any system of registration, and that the average of these years presents accurately the death-rate of the State. A death-rate of 18 — possibly a fraction over — we believe to be the average per 1,000 of the population for New Hampshire, a rate probably as low as can be found in any State in the Union, and considerably below that of some of the States. By this we do not mean to assert that New Hampshire is naturally more healthful than some other States with a higher death-rate, for in the consideration of this subject nationality, social conditions,

occupations, environments, and many other conditions must be taken into account. The average death-rate for Europe from 1865 to 1883 was 28.1 per 1,000 of the population; for Europe, excluding Russia, it was 25.8; and for Russia alone, 35.7. For Eastern Europe, 35.7; Central Europe, 28.3; Southern Europe, 25.6; Northwestern Europe, 20.5. Massachusetts for a period of thirty years ending 1888, had a mortality rate of 19.48; Austria for thirteen years ending in 1883, 31.0; and for about the same period the death-rate of Greece was 20.8; Denmark, 19.7; Sweden, 18.9; Ireland, 17.8; and Norway, 17.2. In our own country those States which have a reliable system of registration have a death-rate ranging from about 18 to 20 per 1,000 of the population. We can, therefore, upon the basis of our mortality records safely assert that New Hampshire is as healthful a State as any in the Union.

Table No. 2 shows the number of deaths and the death-rate per 1,000 of the population, by counties, for the years 1884 to 1890, inclusive. The highest death-rate has usually been in Hillsborough county, while the lowest, as a rule, has been in Coös. In 1890, the death-rate of Rockingham county was 21.45; Strafford, 20.83; Belknap, 18.40; Carroll, 16.71; Merrimack, 19.88; Hillsborough, 21.14; Cheshire, 18.48; Sullivan, 19.81; Grafton, 17.49; and Coös, 14.17, and the average for the entire State, 19.56. Rockingham, Hillsborough, and Strafford counties present very high rates for the year 1890, while the rate for Coös county is quite low.

TABLE No. 2.

*Deaths and Death-rates, by Counties, from 1884 to 1890, inclusive.**

COUNTIES.	1884.		1885.		1886.		1887.		1888.		1889.		1890.	
	Deaths.	Death-rates.	Deaths.	Death-rates.	Deaths.	Death-rates.	Deaths.	Death-rates.	Deaths.	Death-rates.	Deaths.	Death-rates.	Deaths.	Death-rates.
Rockingham	873	17.69	911	18.43	963	19.46	876	17.67	896	18.05	875	17.61	1,065	21.45
Strafford	627	17.07	619	16.73	609	16.33	673	17.91	688	18.17	691	18.11	801	20.83
Belknap	285	15.09	289	15.12	362	18.71	369	18.84	392	19.78	389	19.40	374	18.40
Carroll	333	18.31	269	14.80	303	16.68	294	16.20	328	18.08	298	16.44	303	16.71
Merrimack	736	15.48	796	16.63	833	17.29	835	17.22	920	18.86	891	18.15	983	19.88
Hillsborough	1,655	20.02	1,701	20.15	1,681	19.51	1,697	19.38	1,846	20.59	1,740	19.04	1,973	21.14
Cheshire	497	17.06	494	16.90	475	16.19	482	16.39	488	16.52	525	17.72	557	18.49
Sullivan	273	15.32	284	16.02	328	18.59	283	16.12	327	18.72	314	18.06	332	19.81
Grafton	652	17.06	611	16.05	616	16.24	602	15.93	655	17.35	625	16.67	651	17.49
Coös	263	12.88	227	10.87	256	12.00	368	16.89	314	14.11	348	15.32	329	14.17
Total	6,194	17.26	6,201	17.13	6,426	17.61	6,479	17.61	6,854	18.48	6,696	17.91	7,368	19.56

* Population estimated for all but census years.

TABLE No. 3.

Percentages of Deaths, by Quarters, from 1884 *to* 1890, *inclusive.**

YEARS.	Percentage of deaths for quarters ending with			
	March.	June.	Sept'mb'r.	December.
1884	23.23	23.40	26.63	26.74
1885	27.27	26.66	24.32	21.75
1886	23.75	23.27	28.90	24.08
1887	24.56	24.02	27.77	23.65
1888	25.94	23.72	26.82	23.52
1889	23.70	24.16	27.38	24.76
1890	28.82	21.63	26.71	22.84

* Not including deaths with month not stated, premature and still births.

Table No. 3 shows the percentages of deaths, by quarters, from 1884 to 1890, inclusive. It will be noticed that the greatest mortality usually occurs during the quarter ending with September, while for the other three quarters it is more nearly uniform. The increased rate recorded for the third quarter of the year is doubtless due to cholera infantum, which is most prevalent during July, August, and September. For the year 1890 this order is changed and the quarter ending with March has the greatest mortality, due to the increased number of deaths from pneumonia and other diseases of the respiratory organs which prevailed during those months, and to the wide-spread epidemic of influenza that either as a primary cause or as a complication of those diseases produced so marked an effect upon the death-rate of the State. For the first quarter of the year the percentage of deaths to the total mortality for the year was 28.82; for the second, 21.63; for the third, 26.71; and for the last, 22.84.

TABLE No. 4.

Mortality of Males and Females compared, 1884 *to* 1890, *inclusive.*

YEARS.	Male decedents.	Female decedents.	Male decedents to 100 female decedents.	Death-rate of males to 1,000 male population.*	Death-rate of females to 1,000 of female populat'n.*
1884	3,034	3,122	97.18	17.79	17.69
1885	2,948	3,194	92.29	17.28	18.09
1886	3,155	3,212	98.20	18.50	18.20
1887	3,174	3,267	97.15	18.61	18.51
1888	3,419	3,382	101.09	20.04	19.16
1889	3,253	3,389	95.98	19.07	19.20
1890	3,692	3,624	101.87	21.65	20.53
Average	3,239	3,312	97.79	18.99	18.77

* Population of 1880.

Table No. 4 exhibits the mortality of males and females compared for the years 1884 to 1890, inclusive. With the exception of the years 1888 and 1890, the female decedents have exceeded the males. By a comparison of the death-rates of the respective sexes to each 1,000 of the living population of that sex it will be seen that the average mortality rate of the male population is slightly higher than that of the female. These figures are based upon the census of 1880, and it may here be remarked, parenthetically, that it is to be regretted that the classification of the sexes, census of 1890, is not yet available for use; therefore the deductions from this table, as well as from a few others are not so accurate as they otherwise might have been.

TABLE No. 5.

Deaths at Age Periods by Percentages, from 1883 *to* 1890, *inclusive.**

YEARS.	Under 1.	1 to 5.	5 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	Over 60.
1883	14.13	7.58	2.56	5.55	8.58	6.73	6.22	7.64	37.93
1884	16.22	7.36	2.61	5.30	7.93	6.26	6.33	7.75	38.38
1885	15.98	7.14	2.11	4.42	7.50	6.71	6.71	7.76	40.09
1886	16.89	7.70	2.86	4.82	7.73	6.55	6.12	7.47	38.86
1887	17.64	7.26	2.05	4.89	6.96	6.25	6.56	7.72	39.70
1888	19.23	7.63	2.04	4.93	7.07	6.00	5.53	7.57	38.72
1889	19.44	7.71	2.66	4.64	6.56	6.15	5.93	7.63	38.40
1890	16.23	6.67	1.99	4.28	7.04	2.12	6.62	9.17	40.49

*Not including those with age not stated, premature and still births.

TABLE No. 6.

Deaths at Different Periods, compared with the Number Living at the Same Period, 1890.*

	Deaths 1890.	Persons living at same ages, census of 1880.	Death-rate per 1,000.
Under 1 year	1,146	6,141	186.61
Under 5 years	1,614	30,573	52.79
20 to 30 years	492	63,252	7.77
All others	5,000	253,166	19.74
All ages	7,106	376,530†	18.87

* Excluding still births and premature births. † Census of 1890.

Table 6 exhibits the number of deaths at different age periods compared with the number living at the same period, based upon the census of 1880, with the exception noted in the table. This table shows a death-rate per 1,000 of the population under one year of age, of 186.61 as against 165.14 for the preceding year; under five years of age, 52.79 as against 50.04 for 1889; between twenty and thirty, 7.77 in 1890, and 6.94 in 1889; all others, 19.74 in 1890, and 17.53 in 1889; for all ages the rate was 18.87 in 1890, and 18.46 in 1889.

TABLE No. 7.

Deaths by Ages and Sex, from 1884 *to* 1890, *inclusive.**

YEARS.	Under 1.	1 to 5.	5 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	90 to 100.	Over 100.	Unknown.
1884..Males	460	243	72	136	224	168	180	245	322	502	292	30	1	60
Females	353	212	90	192	266	220	211	235	336	444	379	70	...	51
Not stated	3	1	.....	.....	1	.....	1	.....	1	.....	.....	...	...	4
Total	816	456	162	328	491	388	392	480	659	946	671	100	1	115
1885..Males	416	225	62	109	190	181	190	252	394	478	284	32	1	43
Females	371	217	68	164	275	235	226	225	355	463	398	74	2	50
Not stated	18	1	1	1	.....	.....	.....	4	2	3	.....	....	...	5
Total	805	443	131	274	465	416	416	481	751	944	682	106	3	98
1886..Males	487	273	94	132	205	188	198	228	368	499	317	42	2	33
Females	385	221	90	178	292	233	195	252	339	447	397	83	3	28
Not stated	19	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	...	3
Total	891	495	184	310	497	421	393	480	707	946	714	125	5	64
1887..Males	490	231	71	142	196	184	186	254	377	512	336	45	1	34
Females	416	239	61	175	255	221	239	246	358	494	350	93	6	28
Not stated	8	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	....	...	1
Total	914	470	133	317	451	405	425	500	735	1,006	686	138	7	63

1888..	Males	588	280	75	144	213	177	180	257	392	507	377	47	1	57
	Females	459	243	65	194	271	241	199	262	375	511	360	79	5	23
	Not stated	13													1
	Total	1,060	523	140	338	484	418	379	519	767	1,018	737	126	6	81
1889..	Males	536	269	90	131	187	186	175	241	381	492	342	43		29
	Females	470	245	88	179	251	226	222	270	398	471	366	75	3	29
	Not stated	8	2		1	1									1
	Total	1,014	516	178	311	439	412	397	511	779	963	708	118	3	59
1890..	Males	609	250	73	143	229	242	220	308	422	576	368	52		59
	Females	524	216	66	156	263	277	242	332	399	513	406	86	5	44
	Not stated	13	2								1				10
	Total	1,146	468	139	299	492	519	462	640	821	1,090	774	138	5	113

* Excluding still births and premature births.

Table 7 shows the number of deaths at different age periods by sex, from 1884 to 1890, inclusive. In the year 1890 there were returned 1,146 deaths of children under one year of age, not including still and premature births; 468, between one and five; 138, between five and ten; 299, between ten and twenty; 492, between twenty and thirty; 519, between thirty and forty; 462, between forty and fifty; 640, between fifty and sixty; 821, between sixty and seventy; 1,090, between seventy and eighty; 774, between eighty and ninety; 138, between ninety and one hundred; and five, over one hundred years of age; also, 113, with age not stated. Compared with the returns for the previous year, there was an increased mortality in decedents under one year of age, while the increase in the mortality at each age period from twenty years upward is very noticeable.

Table 8 shows the percentages of deaths, by age periods and sex, to the total mortality from 1884 to 1890, inclusive. Tables 7 and 8 are interesting and instructive inasmuch as they give the number of deaths and the percentage to the total mortality by age periods, for the seven years embraced in the tables. There are no other tables that so emphatically exhibit the large mortality that annually occurs among children under one year of age. It will be seen that nearly one fourth of all the deaths in the State for the year 1890 were of children under five years of age, and the same is true every year. This excessive mortality among the young offers a subject for reflection and study for those who are interested or engaged in efforts to reduce the mortality rate of the State. It is admitted by those who have given the subject any attention that so large a death-rate among children is entirely preventable, and that the means are at the command of the individual and the public to reduce these figures very materially. This view is emphatically corroborated by a detailed exhibit of the causes of death among children.

TABLE No. 8.

*Percentages of Deaths by Ages and Sex to Total Mortality, from 1884 to 1890, inclusive.**

YEARS.	Under 1.	1 to 5.	5 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	90 to 100.	Over 100.
1884..Males	16.00	8.45	2.51	4.73	7.79	5.84	6.26	8.52	11.20	17.46	10.16	1.04	.04
Females	11.74	7.05	2.99	6.38	8.84	7.31	7.02	7.81	11.17	14.76	12.60	2.33	....
Total	13.82	7.73	2.75	5.57	8.33	6.60	6.65	8.16	11.18	16.08	11.41	1.70	.02
1885..Males	14.78	8.00	2.20	3.87	6.75	6.43	6.75	8.96	14.00	16.99	10.09	1.14	.04
Females	12.07	7.06	2.21	5.34	8.95	7.65	7.35	7.32	11.55	15.07	12.95	2.41	.07
Total	13.37	7.51	2.21	4.64	7.95	7.07	7.07	8.10	12.72	15.98	11.58	1.80	.05
1886..Males	16.06	9.00	3.10	4.35	6.75	6.20	6.53	7.52	12.13	16.45	10.45	1.39	.07
Females	12.36	7.10	2.89	5.71	9.37	7.48	6.26	8.09	10.88	14.35	12.74	2.67	.10
Total	14.18	8.04	2.99	5.04	8.08	6.85	6.39	7.81	11.50	15.39	11.62	2.03	.08
1887..Males	16.20	7.64	2.35	4.69	6.48	6.08	6.15	8.40	12.46	16.92	11.11	1.49	.03
Females	13.19	7.58	1.94	5.55	8.09	7.01	7.58	7.80	11.35	15.67	11.10	2.95	.19
Total	14.67	7.61	2.14	5.13	7.30	6.56	6.88	8.09	11.90	16.28	11.10	2.23	.11
1888..Males	18.16	8.65	2.31	4.45	6.58	5.47	5.56	7.94	12.10	15.66	11.64	1.45	.03
Females	14.06	7.45	1.99	5.94	8.30	7.38	6.10	8.03	11.49	15.66	11.03	2.42	.15
Total	16.10	8.04	2.15	5.20	7.44	6.43	5.83	7.98	11.80	15.66	11.34	1.94	.09

* Excluding those with age and sex not stated, and premature and still births.

TABLE No. 8. — *Continued.*

Percentages of Deaths by Ages and Sex, to Total Mortality from 1884 *to* 1890, *inclusive.*

YEARS.	Under 1.	1 to 5.	5 to 10.	10 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	80 to 90.	90 to 100.	Over 100.
1889.. Males	17.44	8.75	2.93	4.26	6.09	6.05	5.70	7.84	12.40	16.01	11.13	1.40	....
Females	14.40	7.51	2.70	5.48	7.69	6.92	6.80	8.27	12.20	14.43	11.21	2.30	.09
Total	15.88	8.11	2.81	4.89	6.91	6.50	6.27	8.06	12.29	15.20	11.17	1.86	.05
1890.. Males	17.44	7.15	2.09	4.09	6.55	6.93	6.30	8.82	12.08	16.49	10.54	1.49	....
Females	15.03	6.19	1.89	4.47	7.54	7.94	6.94	9.52	11.45	14.72	11.65	2.46	.14
Total	16.23	6.67	1.99	4.28	7.04	7.43	6.62	9.17	11.76	15.60	11.09	1.97	.07

TABLE No. 9.

Deaths of Children under Five Years of Age, by Seasons, 1890.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Months.....	132	81	109	90	76	91	197	289	228	120	112	89
Quarters.....		322			257			714			321	
Percentages..		19.95			15.92			44.23			19.88	
Half-years ...			579						1,035			
Percentages..			35.87						64.12			
Total deaths..							1,614					

This table represents the mortality of children under five years of age, by seasons, for the year 1890. The greatest mortality of the year occurred in the quarter embracing the months of July, August, and September, and was 44.23 per cent of the total mortality among children, as against 19.95 per cent for the first quarter, 15.92 per cent for the second, and 19.88 per cent for the last quarter of the year. There were 1,614 deaths among children under five years of age during the year.

TABLE No. 10.

Deaths by Seasons, 1890.*

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Months	897	567	582	520	515	500	604	666	626	562	537	522
Quarters		2,046			1,535			1,896			1,621	
Percentages		28.82			21.63			26.71			22.83	
Half-years			3,581						3,517			
Percentages			50.45						49.54			
Total deaths					7,098							

* Not including deaths with month not stated, premature and still births.

This table gives the total number of deaths at all ages, by seasons, for the year 1890. There was a total of 7,098 deaths, not including those with month not stated, premature and still births. The greatest mortality was in the month of January, 897, and the least, 500, in June. The percentages, by quarters, were as follows: First quarter, 28.82 per cent of the total; second, 21.63; third, 26.71; and fourth, 22.83.

TABLE No. 11.

Nativity of Persons Deceased for 1890, *by Counties.*

COUNTIES.	Total deaths.*	Native-born.		Foreign-born.	
		Deaths.	Percentages.	Deaths.	Percentages.
Rockingham	1,065	809	89.29	97	10.71
Strafford	801	613	82.06	134	17.94
Belknap	374	294	91.02	29	8.98
Carroll	303	251	95.80	11	4.20
Merrimack	983	779	88.12	105	11.88
Hillsborough	1,973	1,457	80.36	356	19.64
Cheshire	557	452	91.13	44	8.87
Sullivan	332	279	91.18	27	8.82
Grafton	651	519	93.68	35	6.32
Coös	329	219	81.11	51	18.89
Total	7,368	5,672	86.45	889	13.55

* Including those whose nativity was not recorded. In the calculations of percentages, the rates are not given to the *total* reported deaths, but only to the total of those cases where the nativity was stated.

This table gives the nativity of the decedents for the year 1890, together with the percentages of each, by counties. The greatest number of foreign-born decedents, as well as the highest rate, was in Hillsborough county, where there is a larger foreign-born population, being 356 or 19.64 per cent; Strafford follows with 134, although the rate, 17.94, is not so high as in Coös where there were 51 deaths and a rate of 18.89; Merrimack county had 105 deaths among the foreign-

born population and a rate of 11.88; Rockingham, 97, and a rate of 10.71; Cheshire, 44, and a rate of 8.87; Belknap, 29, and a rate of 8.98; Grafton, 35, and a rate of 6.32; Sullivan, 27, and a rate of 8.82; and Carroll, 11, with a rate of 4.20. The total foreign-born decedents for the State was 889, a rate of 13.55.

TABLE No. 12.

Nativity of Persons Deceased from 1884 *to* 1890, *inclusive.*

YEARS.	Total deaths.*	Native-born.		Foreign-born.	
		Deaths.	Percentages.	Deaths.	Percentages.
1884	6,194	4,868	89.01	601	10.99
1885	6,201	4,847	89.35	578	10.65
1886	6,426	4,989	88.52	647	11.48
1887	6,479	5,131	88.03	698	11.97
1888	6,854	5,449	87.53	776	12.47
1889	6,696	5,383	88.00	734	12.00
1890	7,368	5,672	86.45	889	13.55

* Including those whose nativity was not recorded. In the calculations of percentages, the ratios are not given to the *total* reported deaths, but only to the total of those cases where the nativity was stated.

Table No. 12 shows the number of native and foreign-born decedents in the State for each year from 1884 to 1890, inclusive, with percentages of each. Of a total of 7,368 deaths in the State, 5,672, or 86.45 per cent, were native born, and 889, or 13.55 per cent, foreign-born. In 807 cases the nativity was not given, but doubtless belonged largely to the foreign-born.

TABLE No. 13.

Deaths in 1890, *Aged One Hundred Years, or more.*

Date of death.	NAME.	Age.			Place of death.	Birthplace.	Single, married, or widowed.
		Years.	Months.	Days.			
July 30	Sally Brown	105	1	15	Chichester	Epping	Widow.
Sept. 19	Clarissa Wilson	101	4	5	Hillsborough Br.	Hillsborough	Widow.
Nov. 2	Clarissa H. Towne	100	8	21	Milford	Concord	Widow.
Jan. 24	Mary Harrington	102			Manchester	Ireland	Widow.
Feb. 20	Mrs. Buckman	100	6	7	Lancaster		

Table 13 presents a list of the centenarians who died during the year 1890, all females. In 1889 there were three, one male and two females, who had reached the age of 100 years or over.

CAUSES OF DEATH.

There were returned for the year 1890, 7,368 deaths — 3,692 males, 3,624 females, and 52 with sex not stated. In 337 cases the cause of death was unclassified or not stated: this was due in many cases either to the neglect of the physician to return the cause in his certificate of death, failure of the local registrar to comprehend or decipher the term given in the physician's certificate, or the use of some meaningless term, such as "hemorrhage" or "inflammation," which it was impossible to classify without knowing the organ or organs affected. The term "heart failure" is used by some in such an indiscriminate manner as to give no information whatever, except the bare fact of death.

TABLE No. 14.

Causes of Death, by Classes, 1884 *to* 1890, *inclusive.*

	1884.	1885.	1886.	1887.	1888.	1889.	1890.
I. — Zymotic diseases	907	890	1,095	1,073	1,097	1,172	1,155
II. — Constitutional diseases	1,276	1,271	1,284	1,222	1,200	1,114	1,309
III. — Local diseases	2,594	2,637	2,610	2,731	2,994	2,852	3,146
IV. — Developmental diseases	857	848	948	952	1,016	1,041	1,150
V. — Violent deaths	201	225	206	218	234	233	271

This table gives the causes of death by classes for the years 1884 to 1890, inclusive. It will be noticed that in 1890 there was quite a marked increase in the number of deaths from constitutional, local, and developmental diseases. Comparing the record of 1890 with that of the preceding year it will be seen that there was a slight falling off in the zymotic

diseases, a class generally believed to be more readily avoided or prevented than any other. The increased mortality from diseases of the second, third, and fourth classes is doubtless due largely if not entirely to the prevalence of epidemic influenza. In class five, violent deaths, there is a remarkable uniformity from year to year.

TABLE No. 15.

Percentage of Causes of Death, by Classes, 1884 *to* 1890, *inclusive.**

YEARS.	Classes.				
	Zymotic.	Constitutional.	Local.	Developmental.	Violent deaths.
1884	15.9	22.4	45.7	12.3	3.5
1885	13.9	22.2	46.0	12.2	3.6
1886	18.2	21.4	43.4	13.4	3.4
1887	17.9	20.4	45.7	12.1	3.6
1888	17.4	19.1	47.6	12.0	3.7
1889	19.1	18.2	46.5	12.3	3.8
1890	17.0	19.3	46.5	13.1	4.0

* Excluding deaths from unspecified causes, premature and still births.

Table 15 gives the percentages of causes of death, by classes, excluding deaths from unspecified causes, premature and still births from the year 1884 to 1890, inclusive. This table presents substantially the same information as table 14, but in the form of percentages. The relative fatality of each class of diseases is vividly shown. The falling off in the zymotic diseases in 1890, reduced the percentage from 19.1 to 17.0 in 1890, while the other classes show a greater or less increase.

TABLE No. 16.

Causes of Death, by Classes and Counties, 1890.

COUNTIES.	Zymotic.		Constitutional.		Local.		Developmental.		Violent.		Unspecified.		Total.
	Number.	Percentage	Number.	Percentage.	Number.	Percentage	Number.	Percentage.	Number.	Percentage	Number.	Percentage.	
Rockingham	127	11.92	212	19.90	467	43.85	144	13.52	40	3.76	75	7.04	1,065
Strafford	149	18.60	156	19.47	307	38.33	130	16.23	17	2.12	42	5.24	801
Belknap	64	17.11	65	17.37	150	40.10	63	16.84	21	5.61	11	2.94	374
Carroll	21	6.93	50	16.50	166	54.78	36	11.88	9	2.97	21	6.93	303
Merrimack	107	10.88	192	19.53	491	49.95	130	13.22	25	2.54	38	3.87	983
Hillsborough	435	22.05	312	15.82	737	38.87	338	17.13	57	2.88	94	4.76	1,973
Cheshire	98	17.59	78	14.00	236	42.36	87	15.62	38	6.82	20	3.59	557
Sullivan	36	10.84	68	20.48	153	46.08	53	15.96	16	4.81	6	1.80	332
Grafton	72	11.06	113	17.36	301	46.23	119	18.22	26	3.99	20	3.07	651
Coös	46	13.98	63	19.14	138	41.94	50	15.19	22	6.68	10	3.03	329
Total	1,155	15.67	1,309	17.76	3,146	42.70	1,150	15.61	271	3.68	337	4.58	7,368

This table gives the causes of death, by classes and counties, for 1890, with the percentages of each to the total number of deaths, and including deaths from unspecified causes, premature and still births, which accounts for the differences in the percentages in tables 15 and 16; the former gives the percentage of each class to the total number of specified causes, excluding premature and still births, while the latter gives the percentage of each class to the total number of all classes. The highest percentage in the zymotic class is in Hillsborough county, 22.05; Strafford, 18.60; Cheshire, 17.59; Belknap, 17.11; Coös, 13.98; Rockingham, 11.92; Grafton, 11.06; Merrimack, 10.88; Sullivan, 10.84; and the lowest in Carroll county, 6.93. The percentage of deaths in this class for the entire State was 15.67 to the total mortality, as against 17.50 for 1889.

The percentages in the class of constitutional diseases do not vary so much in the different counties, the highest rate being 20.48 in Sullivan county, followed by 19.90 in Rockingham, 19.53 in Merrimack, 19.47 in Strafford, 19.14 in Coös, 17.37 in Belknap, 17.36 in Grafton, 16.50 in Carroll, 15.82 in Hillsborough, and the lowest, 14.00 in Cheshire. The percentage of this class for the whole State was 17.76 in 1890, and 16.63 the previous year.

In the class of local diseases the highest rate was in Carroll county, 54.78; Merrimack, 49.95; Grafton, 46.23; Sullivan, 46.08; Rockingham, 43.85; Cheshire, 42.36; Belknap, 40.10; Hillsborough, 38.87; and Strafford, 38.33. Rate for the State, 42.70 in 1890 and 42.59 the preceding year.

In developmental diseases the rate is very uniform throughout the State. Grafton county has the highest rate of the year, 18.22, then follow Hillsborough county with a rate of 17.13; Belknap, 16.84; Strafford, 16.23; Sullivan, 15.96; Cheshire, 15.62; Coös, 15.19; Rockingham, 13.52; Merrimack, 13.22; and Carroll, 11.88. Rate for the State, 15.61. In 1889 the rate was 15.54.

There were 271 violent deaths, being 3.68 per cent of the total mortality of the State. Of these 217 were reported

under accident or negligence, 6 homicide, 38 suicide, and 10 from other violent causes.

TABLE No. 17.

Mortality from Prominent Zymotic Diseases from 1884 *to* 1890, *inclusive.*

YEARS.	Diseases.												
	Cholera infantum.	Croup.	Diarrhea.	Diphtheria.	Dysentery.	Erysipelas.	Fever, cerebro-spinal.	Fever, typhoid.*	Measles.	Pertussis.	Scarlatina.	Septicæmia.	Total.
1884	266	49	53	110	80	19	25	137	3	14	52	27	835
1885	219	74	59	78	40	25	20	136	45	25	53	38	812
1886	362	64	38	156	79	18	26	194	18	26	21	27	1,029
1887	336	84	38	177	53	20	34	134	39	21	26	30	992
1888	370	94	50	103	63	36	34	150	55	23	34	29	1,041
1889	353	88	68	210	67	27	25	161	16	47	18	29	1,109
1890	399	64	50	164	48	29	...	143	9	26	16	57	1,005
Average	329	73	50	142	61	25	23	151	26	26	31	34	974

* Including fever, bilious, and typho-malarial fever.

Table 17 exhibits the mortality from prominent zymotic diseases. Cholera infantum was the cause of more than one third of all the deaths in this class, 399 in a total of 1,005, and more than reported in any preceding year; typhoid fever caused 143 deaths, a smaller number than has been reported from this cause since 1885, with one exception, 134 in 1887, and the average for the past six years has been 151. Diphtheria ranks

second in this class for the year 1890, having caused 164 deaths; the largest numbe: reported in the past seven years was in 1889 when there were 210 deaths from this cause, the average being 142. There were 64 deaths from croup, the same as reported in 1886 and less than has been recorded in any one year since that date; the average for the past seven years has been 73. The other diseases in this table are considered under special heads.

TABLE No. 18.

Mortality from Principal Constitutional Diseases from 1884 *to* 1890, *inclusive.*

YEARS.	Diseases.										
	Dropsy.	Anæmia.	Cancer.	Mortification.	Rheumatism.	Scrofula.	Tabes mesenterica.	Phthisis (pulmonary).	Hydrocephalus.	Tubercular meningitis.	Total.
1884	80	43	213	18	26	26	4	865	27	*	1,302
1885	90	32	212	24	28	22	2	857	25	*	1,292
1886	83	28	206	27	47	16	11	809	33	19	1,279
1887	79	17	218	29	47	16	7	766	23	16	1,218
1888	75	34	203	22	43	21	14	742	30	13	1,197
1889	62	40	213	21	43	22	13	651	21	24	1,110
1890	53	28	276	33	30	15	6	825	13	30	1,309
Average	74	31	223	24	37	19	8	787	24	14	1,243

* Not classed separately.

The mortality from the principal constitutional diseases from 1884 to 1890, inclusive, are shown in this table.

Phthisis stands at the head of all the diseases as a cause of death, the record for the year 1890 being 825 deaths from this cause alone. This is the largest number reported since 1885 when there were 857 deaths recorded; in 1886, there were 809 deaths; in 1887, 766; in 1888, 742; and in 1889, there was the smallest number reported in the past seven years, 651, the average being 787. There was also an unusual increase in the mortality from cancer, there being 276 cases during the year 1890. The records of this disease for the six years prior to 1890 are very uniform and the largest number previously reported was 218 in 1887. The average for seven years has been 223 cases.

TABLE No. 19.

Mortality from Principal Local Diseases, 1884 *to* 1890, *inclusive.*

YEARS.	Diseases.													
	Apoplexy.	Paralysis.	Convulsions.	Cephalitis.*	Brain disease.	Heart disease.	Bronchitis.	Pneumonia.	Enteritis.	Gastritis.	Peritonitis.	Liver disease.	Bright's disease, nephritis, and other kidney diseases.	Total.
1884	192	248	99	120	134	507	78	436	69	44	61	63	140	2,191
1885	206	278	93	133	122	489	112	504	57	49	44	63	157	2,307
1886	220	249	71	141	127	510	81	466	53	66	48	71	143	2,246
1887	210	253	64	117	121	552	114	556	57	54	48	69	163	2,384
1888	243	273	88	143	112	575	142	628	39	51	63	72	154	2,634
1889	259	196	76	151	126	564	127	582	56	42	57	56	200	2,492
1890	263	251	65	186	140	568	194	703	63	60	51	56	201	2,801
Average	227	249	79	141	126	537	121	553	56	52	53	64	165	2,435

* Meningitis and cerebritis included.

Table 19 records the mortality from the principal local diseases from 1884 to 1890, inclusive, and an average for seven years of 2,435 cases in this class. Pneumonia was the most fatal disease in this class for the year 1890, 703 deaths, more than ever before returned from this cause; in 1888, there were 628 deaths; in 1889, 582; in 1887, 556; in 1885, 504; in 1886, 466; and in 1884, 436; the average for seven years ending with 1890 has been 553 deaths from this cause. Heart disease ranks next with 568 deaths in 1890 and an average of 537 for seven years; then follow apoplexy with 263 deaths in 1890 and an average of 227; paralysis, 251 in 1890 and an average of 249; Bright's disease and other kidney diseases, 201 in 1890 and an average of 165; cephalitis, 186 in 1890 and an average of 141; brain disease, 140 in 1890 and an average of 126; bronchitis, 194 in 1890 and an average of 121; convulsions, 65 in 1890 and an average of 79; enteritis, 63 and an average of 56; gastritis, 60 and an average of 52, and peritonitis with 51 in 1890 and an average of 53.

TABLE No. 20.

Mortality from Principal Developmental Diseases from 1884 *to* 1890, *inclusive.*

YEARS.	Diseases.									
	Still-born.	Debility, infantile.	Debility, premature birth.	Malformations.	Teething.	Innutrition.	Childbirth.	Old age.	Atrophy and debility.	Total.
1884	156	*	35	13	19	*	27	457	144	851
1885	145	*	39	13	13	*	31	420	167	828
1886	140	68	54	12	16	50	30	468	98	936
1887	166	56	63	10	20	76	27	449	78	945
1888	189	91	69	19	20	81	20	407	112	1,008
1889	220	79	68	24	18	63	27	426	104	1,029
1890	197	113	65	11	15	95	28	410	204	1,138
Average ...	173	58	56	14	16	52	25	433	129	976

* Classed with atrophy and debility.

The above table shows the mortality from the principal developmental diseases from 1884 to 1890, inclusive. Four hundred and ten deaths were classed under old age in 1890 and an average of 433 for seven years; 204, under atrophy and debility and an average of 129; 197, still-born and an average of 173; under innutrition, 95 with an average of 52; infantile debility, 113 and an average of 58.

TABLE No. 21.

Mortality from Twenty Prominent Causes, 1884 to 1890, inclusive.

CAUSES OF DEATH.	Deaths in 1890.	Order of Fatality.						
		1890.	1889.	1888.	1887.	1886.	1885.	1884.
Consumption	825	1	1	1	1	1	1	1
Pneumonia	703	2	2	2	3	5	2	5
Heart disease	568	3	3	3	2	2	4	2
Apoplexy and paralysis	514	4	4	4	4	3	3	4
Old age	410	5	5	5	5	4	5	3
Cholera infantum	399	6	6	6	6	6	6	6
Cancer	276	7	7	7	7	7	7	7
Diphtheria	164	12	8	15	9	10	18	13
Accident and negligence	217	8	9	8	8	9	8	11
Typhoid fever*	143	13	10	9	10	8	9	10
Cephalitis †	186	11	11	10	12	11	10	12
Diarrhea and dysentery	98	17	12	12	14	13	15	9
Bright's disease	111	16	13	20	15	15	14	14
Bronchitis	194	10	14	11	13	17	12	17
Brain disease	140	14	15	13	11	12	11	8
Atrophy and debility	204	9	16	14	18	14	13	18
Croup	64	21	17	16	16	21	19	22
Debility, infantile	113	15	18	17	23	22	‡	....
Convulsions	65	20	19	18	21	19	16	15
Innutrition	95	18	20	19	19	23	‡	....
Influenza	94	19	....	....	....	....	....	....

* Fever, bilious fever, and typho-malarial fever included.
† Meningitis and cerebritis included. ‡ Classed with atrophy and debility.

DIAGRAM NO. 1. — SHOWING THE COMPARATIVE MORTALITY, BY ABSOLUTE NUMBER OF DECEDENTS, FROM TWENTY PROMINENT CAUSES OF DEATH DURING YEAR ENDING DECEMBER 31, 1890.

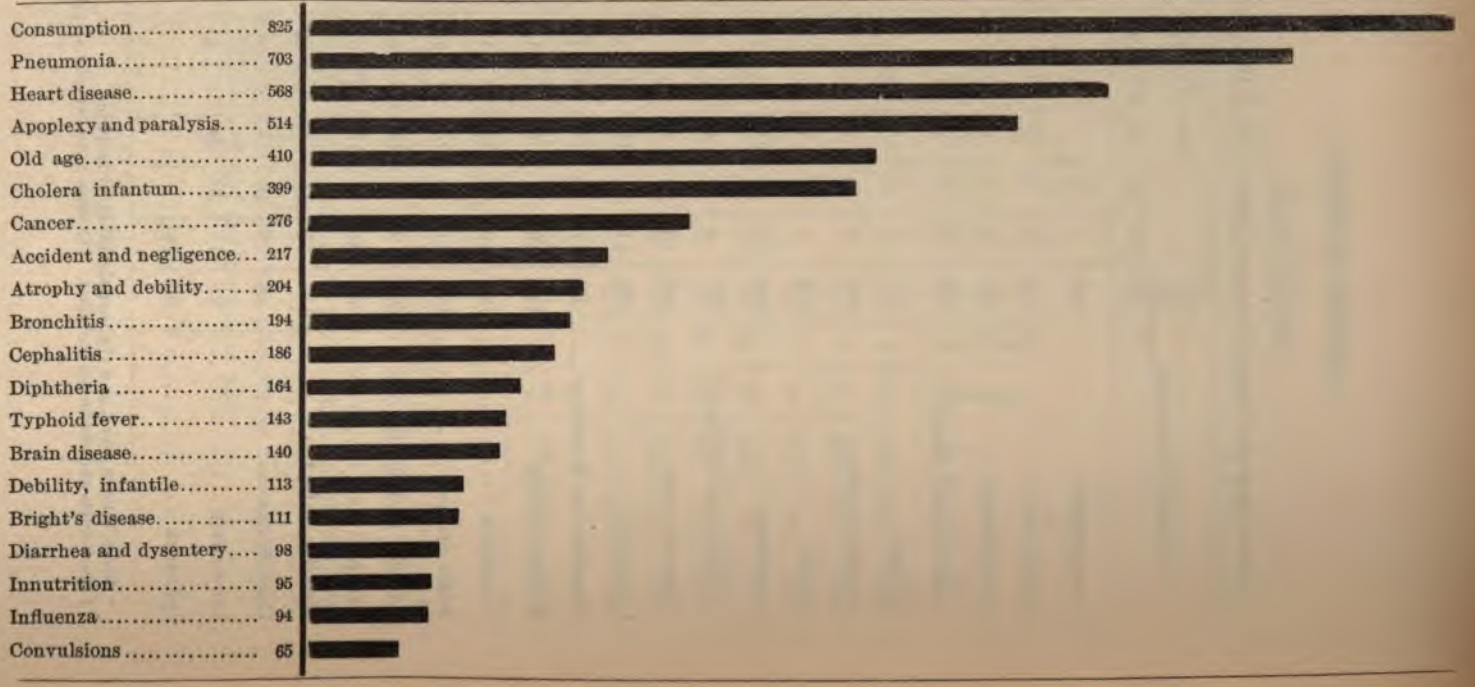

Table 21 gives a comparative view of the mortality from twenty prominent causes of death from 1884 to 1890, inclusive. This table together with the diagram that follows, is interesting in studying the relative positions of the more prominent causes of death from year to year. Consumption in this State, as well as in this and every other country within the pale of civilization, causes more deaths annually than any other disease. Next in order comes pneumonia, although it has not always held second position; in 1887 it was third, and in 1886 and 1884 it was fifth in order of fatality. Heart disease ranks third in 1890, has three times during the seven years given, held second place and once dropped to fourth. Apoplexy and paralysis have been fourth in order with the exception of two years, 1886 and 1885, when they were third. Old age has varied from the third to the fifth position, usually holding the latter place. Cholera infantum has steadily held sixth position and cancer, seventh. Accident and negligence is eighth in the list for 1890 and has varied from that place to the eleventh in 1884. Atrophy and debility, ninth in 1890, shows a large increase over the records of former years; in 1884 and 1887 it was eighteenth in order; in 1889, sixteenth; in 1886 and 1888, fourteenth; and in 1885, thirteenth. This advance is another evidence of the subtle influence of la grippe. Bronchitis was tenth in order in 1890, the highest place it has held during the seven years recorded. Cephalitis was eleventh in order and has not been subject to very great changes. Diphtheria was twelfth in 1890 as against eighth in 1889, ninth in 1887, tenth in 1886, thirteenth in 1884, fifteenth in 1888, and eighteenth in 1885. Typhoid fever has dropped from eighth place in 1886 to thirteenth in 1890, the lowest it has ever been. Brain disease is fourteenth in the list as against fifteenth in 1889, thirteenth in 1888, twelfth in 1886, eleventh in 1887 and 1885, and eighth in 1884. Infantile debility was fifteenth in the list of 1890, a material increase over any previous record, it being seventeenth in 1888, and from the eighteenth to twenty-third in other years. Bright's disease, sixteenth in 1890, was thirteenth in 1889, fourteenth

in 1884 and 1885, fifteenth in 1886 and 1887, and twentieth in 1888. Diarrhea and dysentery were seventeenth in order in 1890, and ranked as high as ninth in 1884. Influenza appears for the first time among the prominent causes of death, holding nineteenth place in the list, with a mortality of 94 as against 4 in 1889.

The long black line at the head of the diagram stands as an appalling sign of the fearful mortality from consumption. Year in and year out, it is accountable for more deaths than any other disease known to mankind. Even the terrible epidemics of cholera and yellow fever that rage in some parts of the world are not so destructive to human life as consumption is in the aggregate. In 1884, 865 deaths were reported from this disease; in 1885, 857; in 1886, 809; in 1887, 766; in 1888, 742; in 1889, 651; and in 1890, 825 cases, making an average of 787 deaths for the past seven years.

TABLE No. 22.

Mortality from Consumption from 1884 *to* 1890, *inclusive.*

YEARS.	Deaths.	Percentages of deaths to deaths from all causes.	Death-rate per 10,000 living population.
1884	865	14.01	24.18
1885	857	13.82	23.68
1886	809	12.58	22.17
1887	766	11.82	20.82
1888	742	10.82	20.01
1889	651	9.72	17.42
1890	825	11.19	21.91
Total	5,515	.....	.....
Average	787	11.99	21.45

The mortality from consumption, the percentage of the same to the total mortality, and the rate per 10,000 of the population, is shown in the above table, for the years 1884 to 1890, inclusive. It will be seen that there was a considerable diminution in the mortality from this disease between the years 1884 and 1889, but was largely increased in 1890. We have entertained the belief that an increased knowledge of the nature of consumption and the measures necessary to restrict and prevent it may have had some influence in causing this reduction. The increased mortality in 1890 does not weaken our opinion, and is to be accounted for, to a large extent if not wholly, by the climatic or other causes to which has been due epidemic influenza or la grippe. That this condition has been a very marked and important factor in causing the increased mortality from certain diseases, has already been shown; therefore we are disposed to attribute the large increase in the deaths from consumption in 1890, to the climatic conditions of this particular period.

TABLE No. 23.

Mortality from Consumption, by Counties, with Percentages of Deaths to Total Mortality, from 1884 *to* 1890, *inclusive.*

COUNTIES.	1884.		1885.		1886.		1887.		1888.		1889.		1890.	
	Deaths.	Percentages.	Deaths.	Percentages.	Deaths.	Percentages.	Deaths.	Percentages.	Deaths.	Percentages.	Deaths.	Percentages.	Deaths.	Percentages.
Rockingham	130	14.89	134	14.70	142	14.74	130	14.84	96	10.71	88	10.05	134	12.58
Strafford	105	16.74	96	15.50	96	15.76	80	11.88	93	13.51	75	10.85	117	14.60
Belknap	54	18.94	50	17.30	37	10.22	48	13.00	46	11.73	42	10.79	40	10.69
Carroll	46	13.81	33	12.26	41	13.53	33	11.22	26	7.92	29	9.73	25	8.25
Merrimack	91	12.36	102	12.81	79	9.48	96	11.49	101	10.97	88	9.87	114	11.59
Hillsborough	229	13.83	233	13.69	218	12.96	179	10.55	209	11.32	168	9.64	204	10.33
Cheshire	62	12.47	75	15.18	60	12.63	50	10.37	47	9.63	53	10.09	51	9.15
Sullivan	36	13.18	36	12.67	45	13.72	32	11.30	36	11.00	28	8.91	32	9.63
Grafton	83	12.73	70	11.45	72	11.72	80	13.28	63	9.61	58	9.27	70	10.75
Coös	32	12.16	28	12.33	19	7.42	38	10.32	25	7.96	22	6.32	38	11.51
Total	868	14.01	857	13.82	809	12.53	766	11.82	742	10.82	651	9.72	825	11.19

Table 23 shows the mortality from consumption, by counties, with percentages to total mortality, from 1884 to 1890, inclusive. Strafford county has the highest rate for the year 1890, 14.60 per cent; Rockingham, 12.58; Merrimack, 11.59; Coös, 11.51; Grafton, 10.75; Belknap, 10.69; Hillsborough, 10.33; Sullivan, 9.63; Cheshire, 9.15; and Carroll the lowest, 8.25.

The mortality from consumption in the cities of the State is shown in the following tables:

TABLE No. 24.

Deaths from Pulmonary Consumption, by Seasons, Ages, and Nativity, 1890, for the City of Manchester.

Months.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	American.	Foreign.	Not stated.	Married.	Single.	Widowed.	Not stated.
	21	4	7	5	8	11	9	9	9	9	4	10								
Quarters	32			24			27			23			106							
Ages ...	Under 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.									
	6	2	8	37	26	14	6	2	2	3			106							
Nativity	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	54	46	6	...	...	...	...
Males ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49	...	...	...	14	10	1	24
Females	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	57	...	...	...	23	15	6	13

Percentage to total mortality of city, 10.29.

This table gives the deaths from consumption, by months, ages, sex, and nativity, in the city of Manchester for the year 1890. The total number of deaths from this cause was 106, as against 78 in 1889. Of these, 49 were males and 57 females; 54 were American-born, 46 foreign, and 6 nativity not stated; 14 males and 23 females were married,

10 males and 15 females single, 1 male and 6 females widowed, and the others not stated. The greatest fatality was in January, 21; June, 11; December, 10; July, August, September, and October, 9 each; May, 8; March, 7; and November, 4. Six of the decedents were under 10 years of age; 2 between 10 and 15; 8 between 15 and 20; 37 between 20 and 30; 26 between 30 and 40; 14 between 40 and 50; 6 between 50 and 60; 2 between 60 and 70; 2 between 70 and 80; and 3 over 80 years of age. The rate to the total mortality of the city was 10.29 per cent.

TABLE No. 25.

Deaths from Pulmonary Consumption, by Seasons, Ages, and Nativity, 1890, for the City of Concord.

Months	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	American.	Foreign.	Not stated.	Married.	Single.	Widowed.	Not stated.
	4	3	3	2	2	4	2	1	3	1	6	3								
Quarters	10			8			6			10			34							
Ages ...	Under 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.									
			2	13	4	3	8	4					34							
Nativity	.....			.....			.....			.....			...	26	3	5	..	..	..	..
Males ..	.....			.....			.....			.....			16	..	..	..	8	7	..	1
Females	.....			.....			.....			.....			18	..	..	..	7	6	5	..

Percentage to total mortality of city, 9.13.

Table 25 is the record of consumption in the city of Concord for the year 1890. There were 34 deaths from this disease — 16 males and 18 females; 26 American-born, 3 foreign, and 5 not stated; 8 males and 7 females married, 7 males and 6 females single, 5 females widowed, and 1 male civil condition not stated. Six died in November; 4 each in January

and June; 3 each in February, March, September, and December; 2 each in April, May, and July; and 1 each in August and October. None of the decedents were under 15 years of age; 2 were between 15 and 20; 13 between 20 and 30; 4 between 30 and 40; 3 between 40 and 50; 8 between 50 and 60; and 4 between 60 and 70. The rate to the total mortality of the city was 9.13 per cent.

TABLE No. 26.

Deaths from Pulmonary Consumption, by Seasons, Ages, and Nativity, 1890, for the City of Nashua.

Months.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	American.	Foreign.	Not stated.	Married.	Single.	Widowed.	Not stated.
	3	3	3	3	3	4	4	2	3	2	3	4								
Quarters		9			10			9			9		37							
Ages ...	Under 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.									
	7		7	6	9	4	4						37							
Nativity	.....			.....			.....			.....			...	20	15	2	..	..	..	..
Males ..	.....			.....			.....			.....			13	..	..	..	5	7	1	..
Females	....		...	.....			...	....		.....			24	..	..	..	10	10	..	4

Percentage to total mortality, 10.69.

Above is the record of the same disease in the city of Nashua for the year 1890, the total number being 37 — 13 males and 24 females; 20 American-born, 15 foreign, and 2 not stated; 5 males and 10 females married, 7 males and 10 females single, 1 male widowed, and 4 females not stated. June, July, and December had 4 deaths each; January, February, March, April, May, September, and November, 3 each; August and October, 2 each. Seven of the decedents were under 10 years of age; 7 between 15 and 20; 6

between 20 and 30; 9 between 30 and 40; 4 between 40 and 50; and 4 between 50 and 60. The percentage to the total mortality of the city was 10.69.

TABLE No. 27.

Deaths from Pulmonary Consumption, by Seasons, Ages, and Nativity, 1890, for the City of Portsmouth.

Months.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	American.	Foreign.	Not stated.	Married.	Single.	Widowed.	Not stated.
	4	4	3	4	4	3	2	2		4	3	4								
Quarters		11			11			4			11		37							
Ages ...	Under 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.									
			4	11	7	5	3	3	3		1		37							
Nativity	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	21	11	5	..	.....	.....	...
Males ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	22	.....	.....	.....	8	10	2	2
Females	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	.....	.....	.....	5	7	1	2

Percentage to total mortality of city, 14.34.

The total mortality from consumption in the city of Portsmouth for the year 1890 was 37 — 22 males and 15 females; 21 American-born, 11 foreign, and 5 not stated; 8 males and 5 females married, 10 males and 7 females single, 2 males and 1 female widowed, and 2 males and 2 females civil condition not stated. In January, February, April, May, October, and December there were 4 deaths each; in March, June, and November, 3 each; and in July and August, 2 each. Four of the decedents were between 15 and 20 years of age; 11 between 20 and 30; 7 between 30 and 40; 5 between 40 and 50; 3 between 50 and 60; 3 between 60 and 70; and 3 between 70 and 80. The percentage to the total mortality of the city was 14.34.

TABLE No. 28.

Deaths from Pulmonary Consumption, by Seasons, Ages, and Nativity, 1890, for the City of Dover.

Months.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	American.	Foreign.	Not stated.	Married.	Single.	Widowed.	Not stated.
Quarters	7	3	4	4	5	4	4	6	2	2	5	6	52							
	14			13			12			13										
Ages . . .	Under 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.									
	1	2	7	16	10	4	7	2	2	1			52							
Nativity	...	...	...	...	...	...	...	...	...	...	...	...	...	36	13	3	...	...	...	...
Males . .	...	...	...	...	...	...	...	...	...	...	...	...	25	...	...	...	8	12	1	4
Females	...	...	...	...	...	...	...	...	...	...	...	...	27	...	...	...	10	8	6	3

Percentage to total mortality of city, 16.40.

The total mortality from consumption in the city of Dover, for the year 1890, was 52 — 25 males and 27 females; 36 of the decedents were American-born, 13 foreign, and 3 not stated; 8 males and 10 females were married, 12 males and 8 females single, 1 male and 6 females widowed, and 4 males and 3 females with civil condition not stated. There were 7 deaths in January; August and December had 6 deaths each; May and November, 5 each; March, April, June, July, 4 each; February, 3; and September and October, 2 each. One decedent was under 10 years of age; 2 between 10 and 15; 7 between 15 and 20; 16 between 20 and 30; 10 between 30 and 40; 4 between 40 and 50; 7 between 50 and 60; 2 between 60 and 70; 2 between 70 and 80; and 1 over 80 years of age. The rate to the total mortality of the city was 16.40 per cent.

TABLE No. 29.

Deaths from Pulmonary Consumption, by Seasons, Ages, and Nativity, 1890, for the City of Keene.

Months.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	American.	Foreign.	Not stated.	Married.	Single.	Widowed.	Not stated.
	1	2	1	2	3	2		2	1	1	1									
Quarters		4			7			3			2		16							
Ages ...	Under 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.									
	1		1	7		1	3	2		1			16							
Nativity	.....			.....			.....			.....			...	12	4	...	...	...	...	...
Males ..	.....			.....			.....			.....			6	...	...	...	3	3	...	...
Females	.....			.....			.....			.....			10	...	...	...	2	7	1	...

Percentage to total mortality of city, 10.25.

The total number of deaths from consumption in the city of Keene, for the year 1890, was 16 — 6 males and 10 females; 12 American-born, and 4 foreign; 3 males and 2 females were married, 3 males and 7 females single, and 1 female widowed. Three of the deaths occurred in May; 2 each in February, April, June, and August; and 1 each in January, March, September, October, and November. One of the decedents was under 10 years of age; 1 between 15 and 20; 7 between 20 and 30; 1 between 40 and 50; 3 between 50 and 60; 2 between 60 and 70; and 1 over 80 years of age. The rate to the total mortality of the city was 10.25 per cent.

TABLE No. 30.

Percentage of Deaths from Consumption to the Total Mortality of the Cities of the State for the years 1883 *to* 1890, *inclusive.*

	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
Manchester	14.89	14.28	13.03	15.01	11.15	12.37	9.30	10.29
Concord...	11.41	8.66	10.68	8.60	10.13	10.23	9.81	9.13
Nashua ...	16.96	13.72	14.86	10.49	9.73	8.20	8.64	10.69
Dover.....	20.97	16.60	16.17	21.17	14.57	12.01	10.31	16.40
Portsmouth	16.02	14.74	12.18	17.84	16.26	13.26	7.73	14.34
Keene.....	16.91	16.60	22.80	16.00	11.90	9.47	9.62	10.25

This table presents a comparative view of the percentage of deaths from consumption to the total mortality of the respective cities of the State, from 1883 to 1890, inclusive. Dover has the highest rate, 16.40 for the year; Portsmouth follows with a rate of 14.34; Nashua, 10.69; Manchester, 10.29; Keene, 10.25; and Concord, 9.13.

Table 31 gives the mortality from consumption, by ages and sex, for the year 1890, by counties. The greatest number of deaths occurred, as usual, between the ages of 20 and 30, 200; between 30 and 40, 156; between 40 and 50, 113; between 60 and 70, 72; between 50 and 60, 65; between 70 and 80, 63; between 15 and 20, 61; under 1, 25; over 80, 23; between 1 and 5, 17; between 10 and 15, 16; and age not stated, 7. Among the decedents were two negroes.

TABLE No. 31.

Deaths from Consumption, by Ages and Sex, by Counties, for 1890.

COUNTIES.	SEX.	Under 1.	1 to 5.	5 to 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Not stated.	Total.	Grand Total.
Rockingham	Males	3	2	....	....	3	16	11	10	7	8	8	2	....	70	....
	Females	1	1	1	2	6	18	11	9	1	5	6	1	2	64	134
Strafford	Males	....	....	....	1	3	15	16	8	4	7	3	1	....	58	....
	Females	4	1	....	4	7	11	11	3	6	3	7	1	1	59	117
Belknap	Males	1	....	....	....	2	....	3	3	3	1	1	1		15	.....
	Females	....	....	....	....	3	7	5	3	....	2	4	....	1	25	40
Carroll	Males	....	....	....	....	....	4	1	3	1	....	2	1	....	12	.....
	Females	1	....	....	....	3	2	....	3	1	1	1	1	....	13	25
Merrimack	Males	1	....	2	1	2	12	6	8	7	7	4	3	....	53	....
	Females	1	....	1	2	3	18	9	8	5	10	4	....	....	61	114
Hillsborough	Males	5	2	1	1	4	23	21	15	1	4	5	1	1	94	.....
	Females	3	6	1	1	15	31	21	3	5	8	3	3	....	110	204
Cheshire	Males	....	2	....	....	....	2	3	4	4	2	3	1	....	21	.....
	Females	1	1	....	....	5	9	7	1	....	2	1	2	....	30*	51

Sullivan	Males	1	....	....	....	....	3	4	1	1	1	1	1	...	13	.....
	Females	1	1	1	1	....	4	2	3	1	1	4	....	...	19	32
Grafton	Males	2	....	....	2	2	3	6	4	1	6	1	....	1	28*	.....
	Females	....	....	....	....	2	11	10	10	3	2	1	2	1	42	70
Coös	Males	...	....	....	...	1	5	3	1	2	2	3	1	...	18	.....
	Females	....	1	...	1	....	6	6	3	1	....	1	1	...	20	38
Total for State	Males	13	6	3	5	17	83	74	57	41	38	31	12	2	382	.....
	Females	12	11	4	11	44	117	82	56	24	34	32	11	5	443	825

* One negro.

TABLE No. 32.

Deaths from Consumption, by Months and Sex, by Counties, for 1890.

COUNTIES.	SEX.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Not stated.	Total.	Grand Total.
Rockingham	Males	10	3	8	10	6	3	3	6	4	7	4	6	...	70	.....
	Females	6	10	3	4	4	4	7	5	1	4	8	8	...	64	134
Strafford	Males	1	3	9	4	4	5	3	8	3	5	7	6		58	.....
	Females	11	2	6	8	4	2	3	1	3	5	6	8		59	117
Belknap	Males	1	2	1	1	1	2	1	2	....	1	2		1	15	.....
	Females	5	1	5	2	1	3	2	1	2	1	1	1		25	40
Carroll	Males	....	....	2	....	1		3	1	1	....	2	2		12	.....
	Females	....	1	1	3	2	2	1	1	....	....	1	1		13	25
Merrimack	Males	5	4	7	4	4	7	4	4	4	2	3	5		53	....
	Females	10	8	5	4	5	3	8	2	7	2	5	2		61	114
Hillsborough	Males	12	5	14	5	8	8	9	7	9	4	3	0		94	.....
	Females	14	6	2	11	11	12	13	7	7	10	6	11		110	204
Cheshire	Males	4	1	1	1	2	3	1		....	3	3	2		21	.....
	Females	3	2	3	3	6	2	1	4	2	2	2			30	51

Sullivan	Males	...	1	3	1	1	1	2	....	1	1	2	...	...	13	....
	Females	1	2	1	3	2	4	....	....	1	1	2	2	...	19	32
Grafton	Males	1	5	2	....	4	2	1	2	3	2	3	3	...	28	....
	Females	4	2	3	7	4	4	2	6	4	1	2	3	...	42	70
Coös	Males	31	2	3	2	1	3	1	1	1	....	....	1	2	...	18	....
	Females	51	2	2	1	3	2	2	....	3	1	....	....	3	...	20	38
Total for State	Males	5	26	50	28	32	34	28	31	26	25	30	36	1	382	....
	Females	5	36	31	46	42	38	39	27	30	27	33	39	...	443	825

Table 32 gives the deaths from consumption, by months and sex, by counties, for 1890. The greatest mortality occurred in the month of January, 90; 81 in May; 75 in December; 74 each in April and May; 72 in June; 63 in November; 67 in July; 62 in February; 58 in August; 56 in September; 52 in October; and 1 not stated. Of the deceedents, 382 were males and 443 females.

TABLE No. 33.

Deaths from Consumption, by Nationality, Civil Condition, and Sex, by Counties, for 1890.

COUNTIES.	SEX.	American.	Foreign.	Not stated.	Married.	Single.	Widowed.	Not stated.	Total.	Grand Total.
Rockingham	Males	48	14	8	29	30	9	2	70	....
	Females	50	8	6	33	24	4	3	64	134
Strafford	Males	41	14	3	27	21	3	7	58	....
	Females	45	11	3	21	23	10	5	59	117
Belknap	Males	13	1	1	8	6	1	...	15	...
	Females	16	6	3	8	11	6	...	25	40
Carroll	Males	11	1		8	2	2	...	12	....
	Females	13	....		2	6	5	...	13	25
Merrimack	Males	44	6	3	24	20	6	3	53	....
	Females	43	9	9	36	15	9	1	61	114
Hillsborough	Males	57	28	9	35	30	4	25	94	....
	Females	62	41	7	40	37	5	18	110	204
Cheshire	Males	16	4	1	11	7	3	...	21	....
	Females	23	6		9	18	2	1	30	51
Sullivan	Males	9	3	1	4	8	1	...	13	...
	Females	17	1	1	8	7	4	...	19	32
Grafton	Males	21	....	7	11	14	3	...	28	....
	Females	35	2	5	28	9	5	...	42	70
Coös	Males	13	3	2	7	6	*4	1	18	....
	Females	7	8	5	11	5	3	1	20	38
Total for State	Males	273	74	35	164	144	36	38	382	....
	Females	311	92	40	196	155	63	29	443	825

* One divorced.

Table 33 gives the nationality, civil condition, and sex of the decedents from consumption, by counties, for 1890. Of the 825 cases, 584 were American-born, 166 foreign, and 75 not stated; 360 were married, 299 single, 98 widowed, 1 divorced, and 67 not stated.

TABLE No. 34.

Mortality from Pneumonia, by Counties, from 1884 *to* 1890, *inclusive.*

COUNTIES.	Years.							Average.
	1884.	1885.	1886.	1887.	1888.	1889.	1890.	
Rockingham	45	63	77	70	83	68	90	71
Strafford	39	48	37	46	52	38	80	48
Belknap	18	24	25	44	50	37	42	34
Carroll	30	27	15	33	46	49	37	34
Merrimack	50	72	60	85	73	86	94	74
Hillsborough	110	128	112	128	129	131	158	128
Cheshire	36	52	39	55	55	52	44	47
Sullivan	21	22	23	22	30	31	32	25
Grafton	66	48	54	52	77	64	74	62
Coös	21	20	24	21	33	26	52	28
Total	436	504	466	556	628	582	703	553

This table gives the mortality from pneumonia, by counties, from 1884 to 1890, inclusive. There were 703 deaths from this disease in 1890, a large increase over the number reported in any previous year and largely exceeding the average of the past seven years. Cheshire was the only county that did not exceed its average for the seven years noted in the table.

TABLE No. 35.

Mortality from Pneumonia, by Ages, from 1884 *to* 1890, *inclusive.*

YEARS.	Under 1 year.	1 to 5.	5 to 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Unknown.	Total.
1884	51	48	3	3	6	27	23	30	36	50	97	54	8	436
1885	69	49	8	4	11	15	27	32	37	72	105	74	1	504
1886	57	38	13	6	13	17	24	29	49	68	92	53	7	466
1887	68	33	7	5	13	28	32	40	48	89	121	68	4	556
1888	67	45	6	10	19	40	49	51	62	67	123	81	8	628
1889	61	50	8	12	17	29	36	40	48	98	100	79	4	582
1890	73	48	9	10	11	35	46	45	79	106	127	107	7	703

The mortality from pneumonia by ages, from 1884 to 1890, inclusive, is given in the above table. The greatest mortality was in the age period between 70 and 80 for the year 1890, there being 127 deaths between those ages, and this holds good in the other years noted. There were 107 deaths of persons over 80 years of age; 106 between 60 and 70; 79 between 50 and 60; 73 under 1 year of age; 46 between 30 and 40; 45 between 40 and 50; 11 between 15 and 20; 10 between 10 and 15; 9 between 5 and 10; and 7 age not stated.

TABLE No. 36.

Mortality from Pneumonia, by Months and Quarters, from 1884 *to* 1890, *inclusive.*

YEARS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Not stated.
1884	55	55	51	52	32	13	14	11	5	28	51	67	2
1885	53	59	101	95	35	25	13	10	10	33	38	32	...
1886	32	44	73	51	51	33	22	18	18	24	46	54	...
1887	71	73	85	85	49	17	13	13	14	34	47	54	1
1888	72	95	75	73	76	24	16	23	21	43	36	72	2
1889	69	66	79	102	51	22	15	19	16	53	41	49	...
1890	213	74	69	43	47	35	18	9	23	23	69	79	1
Total	565	466	533	501	341	169	111	103	107	238	328	407	6
Quarters	1,564			1,011			321			973			
Percentages	40.42			26.13			8.29			25.15			

Table 36 shows the mortality from pneumonia, by months and quarters, from 1884 to 1890, together with percentages. In 1890 the greatest number of deaths from this disease occurred in January, 213; and the aggregate of that month, for the seven years given, 565, is also larger than that of any other month. The smallest number for the year was in August, 9; and the aggregate of that month for seven years, 103, was less than that of any other; 40.42 per cent of all the deaths from pneumonia in the last seven years have occurred in the first quarter of the year; 26.13 per cent, in the second quarter; 25.15 per cent, in the fourth quarter; and 8.29, in the third quarter.

TABLE No. 37.

Mortality from Brain Diseases, 1884 *to* 1890, *inclusive.*

YEARS.	Diseases.						
	Cephalitis.*	Apoplexy.	Paralysis.	Insanity.	Convulsions.	Brain disease.	Total.
1884	120	192	248	22	99	134	815
1885	133	206	278	27	93	122	859
1886	141	220	249	24	71	127	832
1887	117	210	253	25	64	121	790
1888	143	243	273	37	88	112	896
1889	151	259	196	35	76	126	843
1890	186	263	251	28	65	140	933
Average	141	227	248	28	79	126	852

* Meningitis and cerebritis included.

There were 933 deaths from brain diseases in the year 1890, including apoplexy with 263; paralysis, 251; cephalitis, 186; convulsions, 65; insanity, 28; and other brain diseases, 140.

TABLE No. 38.

Mortality from Diarrheal Diseases, 1884 *to* 1890, *inclusive.*

YEARS.	Diseases.					Total of diarrheal diseases.
	Cholera infantum.	Cholera morbus.	Diarrhea.	Dysentery.	Enteritis.	
1884	266	21	52	80	69	488
1885	219	20	40	40	57	376
1886	362	14	38	79	53	546
1887	336	16	38	53	57	500
1888	370	8	50	63	39	530
1889	353	12	68	67	56	556
1890	399	12	..	50	63	524
Average	329	14	40	61	56	502

The total number of deaths from diarrheal diseases in 1890 was 524, a slight increase over the average for seven years. Cholera infantum stands at the head of these diseases with 399 deaths in 1890, and an average of 329; enteritis has an average of 56; dysentery, 61; diarrhea, 40; cholera morbus, 14.

TABLE No. 39.

Mortality from Cholera Infantum from 1884 *to* 1890, *inclusive.*

YEARS.	Deaths.	Percentage of deaths to deaths from all causes.	Death-rates per 10,000 living (estimated population).
1884	266	4.29	7.41
1885	219	3.53	6.05
1886	362	5.63	9.92
1887	336	5.18	9.13
1888	370	5.39	9.98
1889	353	5.27	9.44
1890	399	5.41	10.59
Average	329	....	....

This table shows the mortality from cholera infantum from 1884 to 1890, inclusive; also the percentage to the total mortality and the rate per 10,000 of the population. There has been an average of 329 deaths from this disease for the past seven years.

TABLE No. 40.

Mortality from Cholera Infantum, by Ages, from 1884 *to* 1890, *inclusive.*

YEARS.	Under 1.	1 to 5.	5 to 10.	10 to 15.	15 to 20.	20 to 30.	30 to 40.	40 to 50.	50 to 60.	60 to 70.	70 to 80.	Over 80.	Unknown.	Total.
1884	214	48	...	...	...	...	1	...	1	...	...	...	2	266
1885	186	33	...	...	...	...	...	...	...	...	...	...	...	219
1886	283	77	2	...	...	...	...	...	...	...	...	...	...	362
1887	284	51	...	...	...	...	...	...	...	...	...	...	1	336
1888	298	70	...	...	...	...	...	...	...	...	...	...	2	370
1889	297	54	1	...	...	...	...	...	...	...	...	...	1	353
1890	343	52	4	...	...	...	...	...	...	...	...	...	...	399

This table shows the mortality from cholera infantum, by ages, from 1884 to 1890, inclusive. The largest number reported in any one year was 399 in 1890, followed by 370 in 1888; 362 in 1886; 353 in 1889; 336 in 1887; 266 in 1884; and 219 in 1885. In 1890 of the 399 decedents, 343 were under 1 year of age, 52 between 1 and 5, and 4 between 5 and 10 years.

TABLE No. 41.

Cholera Infantum, by Cities.

	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
Manchester.....	131	112	88	122	148	117	86	146
Dover..... ...	7	10	15	15	13	19	5	12
Nashua	15	14	13	30	20	39	43	56
Portsmouth.....	4	3	9	6	4	9	9	8
Concord.....	9	12	5	7	8	11	13	8
Keene	9	6	2	7	5	2	8	5
Total for cities...	175	157	132	187	198	197	164	235
Total for State...	278	268	219	362	336	370	353	399

Table 41 shows the mortality from cholera infantum in the cities of the State. Of the 399 deaths from this disease in the year 1890, 235 occurred in the cities, 146 being recorded in Manchester; 56 in Nashua; 12 in Dover; 8 in each of the cities of Portsmouth and Concord, and 5 in Keene.

REMARKS ON CONTAGIOUS AND INFECTIOUS DISEASES.

A glance at the mortality records of the so called contagious and infectious diseases for the past few years, coupled with a knowledge of the prevalence of these diseases throughout the State for a period longer than that covered by an accurate registration, leads us to believe that the efforts of the local boards of health throughout the State, to restrict and prevent this class of diseases, have been productive of good results. It is observed by physicians that these diseases, especially typhoid fever and scarlet fever, are not so prevalent in this State as formerly. The reduction in the amount of typhoid fever is doubtless due directly to sanitary work, more

especially in the introduction of better water supplies for the general public, together with improved facilities for drainage. It is a matter of history that the introduction of a public water supply into some of the towns of this State has been followed by an almost entire disappearance of typhoid fever. In nearly every village where polluted or contaminated wells have been abandoned, typhoid fever has been reduced in a corresponding ratio. Glancing at the records of this disease we see that the largest number of deaths returned from this cause in a single year was in 1886, 194; in 1889 there were 161 deaths; in 1888, 150; in 1884, 137; in 1885, 136; in 1887, 134; and in 1890, 143. Observing physicians who have been in practice in the State for from 40 to 50 years, assert that in their judgment the prevalence of typhoid fever is not half so great as formerly, and that in some localities where it used to be very common, scarcely a case is now known. We believe that if sanitary regulations were thoroughly and intelligently enforced throughout the State, and if the people could be forced to abandon the use of polluted wells, typhoid fever could be practically banished from every community.

Scarlet fever is another disease that may be controlled by intelligent action. The mortality from this disease has been reduced to quite small proportions. In 1884 there were 52 deaths from scarlet fever in New Hampshire; in 1885, 53; in 1886, 21; in 1887, 26; in 1888, 34; in 1889, 18; and in 1890, 16. This result has been brought about wholly through the work of local health authorities, in causing the immediate isolation of every case, and the better understanding of the nature of the disease by the people themselves. This is a disease that may be effectually controlled by isolation and disinfection, and so promptly has this work been carried out in some localities that it has been restricted to a single case. Formerly scarlet fever raged through town after town in epidemic form, and no thought was given to its restriction, and its spread was frequently furthered by the very general, but erroneous idea that every child must have the disease at some time; hence parents would purposely expose their chil-

dren to a mild case of the disease, thinking it a favorable opportunity, and not realizing that a malignant case was liable to be the result of such exposure. While this low rate of mortality is very gratifying and might be reduced still lower, it is almost too much to expect that these figures can be maintained each and every year. There are periods during which the disease appears to have a thoroughly epidemic tendency, at which times it is more than ordinarily difficult to control; but the fact should not be lost sight of, that it is strictly a preventable disease, and every means known to health authorities and to families should be adopted to prevent its obtaining a foothold and to prevent its spread.

Diphtheria, a contagious and infectious disease, as well as belonging to the preventable class, shows a mortality for 1890 less than that of former years, and is more effectually under the control of health authorities than heretofore. There were 164 deaths from this cause in 1890, as against 210 in 1889. However, the mortality is still very much larger than it should be, and there is no good reason why it cannot be very materially reduced, if every health officer in the State would promptly isolate every case as soon as it appears, and thoroughly disinfect the premises afterward. The truth of this statement has been exemplified in a most convincing manner in many of our towns.

The mortality from measles for the year 1890 was 9, as against 16 the previous year, while in 1888 there were 55 deaths from this disease. The remarks made concerning scarlet fever are substantially applicable to measles. In some States it is classed as one of the dangerous diseases coming within the jurisdiction of the health authorities, and against which stringent restrictive and preventive measures are applied.

The diseases above mentioned are those which have received the especial attention of sanitarians during recent years, and the result is manifest in their lessened prevalence and mortality. This by no means implies that sanitary work has had no effect in other directions. It is well known that

anything that improves the sanitary condition of a locality, increases its healthfulness and renders it less liable to the invasion of disease. The work of the health officer is by no means restricted to the few so called contagious and infectious diseases — indeed, this is but a minor labor in the great field of sanitation. As a result of the investigations and progress in medical science during the past decade, that chief of all diseases, consumption, is transferred to the list of preventable causes of death. Against this terrible malady the united efforts of all the health officers in the civilized world should be directed, and the prospects are, that with determined and united work its terrible ravages may be very materially lessened.

Cholera infantum, which causes so many deaths, especially in the cities of Manchester and Nashua, is believed to be produced by conditions largely within the control of a health department.

The value of sanitary work has been demonstrated beyond any question of doubt, and it only remains to push on the work until there is no longer need of it; until filth and degradation, disease and premature death are supplanted by cleanliness, purity, good health, and happiness.

DUTIES OF BOARDS OF HEALTH.

By virtue of the law of the State every town has a board of health. If no action is taken regarding health officers, the selectmen, *ex officio*, constitute the board of health. A town may, and frequently does, elect a board of health or health officer; but if no action is taken by the town and the selectmen desire to appoint a board of health, they can legally do so, failing to do this they themselves must act as a board of health.

The duties of a board of health are many, exacting, important, and attended with many moral and legal responsibilities. The man who is unprepared to assume all these or who

does not recognize their full import is not fitted to be a health officer. To administer the office as though there were nothing to do but to act reluctantly upon complaints and to draw the usually meagre salary, is to confess an unfitness for the place at the outset. A board of health has duties to perform second in importance to no office within the gift of the town. There is no town, however small, that may not be benefited by an active board of health.

1. A local board of health should inform themselves fully as to the advantages, benefits, and possibilities that sanitary science has in store for all communities; the grand results for the public good that may be and frequently have been accomplished by its teachings, not only in large cities, but also in small towns, hamlets, and even isolated homes. The information may be gathered in a large degree from the reports of boards of health, which may usually be had upon application. After the appointment or election of a board of health, it should organize by choosing one of its members chairman, and another secretary, the latter of whom should keep a careful record of all the doings of the board.

2. The board should establish and promulgate rules and regulations as it may deem necessary for the better preservation of the public health. The regulations must be approved by the selectmen, recorded by the town clerk, and either printed in some newspaper published in the town or posted in two or more public places. The rules and regulations should be carefully and considerately drawn, to the end that the community for which they are intended may be benefited to the greatest possible extent. These rules have the force of law, and for the wilful violation of the same the offender may be punished by fine of $10 for each offense. A sample set of rules and regulations are herewith appended for the guidance of such health officers as may desire to avail themselves of the suggestions contained therein:

RULES AND REGULATIONS OF THE BOARD OF HEALTH OF THE TOWN OF ———.

In pursuance of authority given in section 1, chapter 112, Public Statutes of the State of New Hampshire, we, the undersigned, officers of the board of health of the town of ———, do hereby establish and promulgate the following rules and regulations, which we deem necessary for the better preservation of the public health and the best interests and welfare of the community, namely:

RULE 1. — PRIVIES AND WATER-CLOSETS.

No person shall occupy, lease to, or permit any other person to occupy, any building as a dwelling-house, unless such building be provided with water-closets or privies, and so constructed that none of their contents may escape, to contaminate the surrounding earth or be exposed to the light. No person shall erect, or continue, such place of easement so near to any other dwelling that it may become offensive. All privies and privy vaults shall be thoroughly cleansed at least twice a year, in the spring, not later than May first, and in the fall, not earlier than the first of October, and shall at all times, by the use of disinfectants, dry earth, etc., be kept in a cleanly and inoffensive condition. Any deviation from this order shall not be allowed except by permission of the board.

RULE 2. — DRAINAGE.

Suitable drains and sewers shall be constructed so that sink-water, or any other liquid that may by exposure become putrid and offensive, may be conveyed away and disposed of in such a manner as not to pollute or endanger the water of any spring or well by saturating the earth in the vicinity, or by contaminating the air; and if such refuse matter or sewage be collected in hogsheads, cisterns, or other receptacles, they shall at all times be deodorized and disinfected thoroughly, so as not to disturb the comfort or endanger the health of any person living near, and all persons shall thus take care of their own offal and waste upon their own land in such a manner as not to endanger the health or comfort of any one, and never suffer it to go out upon the premises of another, to their injury, or into the street or public highway. All sinks within one hundred feet of the public sewer must be connected therewith.

RULE 3. — CELLARS.

All cellars must be thoroughly cleaned and ventilated, and all decaying vegetable matter removed from the premises, by the first week in May, and kept so until the first of October. Cellars over which persons live should at all times be kept clean and sweet.

RULE 4. — COLLECTION OF OFFAL.

The collection of refuse matter in or around the immediate vicinity of any dwelling-house, place of business, or public highway — such as swill, waste of meat, fish or shells, bones, decaying vegetables, dead carcasses, excrement, or any kind of offal that may decompose and generate unhealthy gases, and thus affect the purity of the air — shall be considered the worst kind of nuisance, and is absolutely prohibited.

Such substances must be disposed of either by burial, burning, or conversion into fertilizers, and in such manner that it may not be offensive to the neighborhood wherever located.

RULE 5. — STABLES.

Stables, pig-sties, and all other places where animals or fowls are confined, if in proximity to dwelling-houses, places of business, or public highways, must be kept in a cleanly, well ventilated, inoffensive condition; and no hogs or pigs shall be kept within the thickly settled village limits, to the annoyance of any one, or the safety of the public health.

RULE 6. — OVERCROWDING TENEMENTS.

The crowding of tenement houses is prohibited, as this is one of the greatest sources of danger in generating contagious diseases. If any disease shall arise from such cause, the owners will be prosecuted in accordance with the laws of the State.

RULE 7. — OCCUPATION.

If any person shall use or occupy any building in the compact part of this town, or in the immediate vicinity of any dwelling-house, place of business, or public highway, for a slaughter-house, fish-market, for trying tallow, or for currying leather, or for the deposit of green pelts or skins, or for the carrying on of an offensive business, without permission, in writing, of the health officers of this town, he shall be guilty of maintaining a nuisance, and shall be punished accordingly as provided by law.

RULE 8. — REPORTS OF PHYSICIANS.

It shall be the duty of every physician who attends upon any person infected with the small-pox, scarlet fever, diphtheria, or typhoid fever, to immediately report the same to the health officers of this town, together with the residence of such persons so infected.

RULE 9. — REPORTS OF DEATHS.

It shall be the duty of every physician who has had a patient die of small-pox, scarlet fever, diphtheria, or typhoid fever to immediately report the death to the health officers of this town, together with the residence of said person.

RULE 10. — FUNERALS.

Public funerals are prohibited for any person who has died of small-pox, diphtheria, or scarlet fever.

RULE 11. — ATTENDING PUBLIC GATHERINGS.

It shall be unlawful for any person who has become affected with any contagious or infectious disease, or who is recovering from such disease, or for members of the same household, to attend school, church, or any public gathering, or to mingle in society in any way, until the board of health or some person designated by them, certifies that they are no longer liable to communicate said disease.

RULE 12. — ISOLATION.

Isolation of persons affected with small-pox, scarlet fever, and diphtheria is hereby ordered to be enforced immediately upon the appearance of the disease.

RULE 13. — VACCINATION.

No child shall be allowed to attend any public school without presenting a certificate of vaccination from a legally qualified physician, stating that said child, or person has been vaccinated within the last seven years.

RULE 14. — POLLUTING WATER SUPPLIES.

If any person shall place, leave, or cause to be placed or left, any substance or fluid in or near to any lake, pond, or reservoir, or stream tributary thereto, from which the water supply in whole or in part of any city, town, or village is taken for domestic purposes, that may

cause the water thereof to become impure or unfit for the uses for which it is intended, such person shall be punished as provided by law.

Any violation of these regulations may be punished by a fine of ten dollars.

Given under our hands this —— day of ——, 189 .

——— ——— } Board
——— ——— } of
——— ——— } Health.

We approve the above rules and regulations.

——— ——— } Selectmen
——— ——— } of
——— ——— } ———

Received and recorded ———, 189 .

——— ———, *Town Clerk.*

These rules we believe to be generally applicable to every town in the State. It may be found necessary to incorporate other rules for special localities, or to modify those given, as circumstances may require.

3. A board of health should be an active, watchful organization; the law contemplates such. It should not confine its work merely to investigating complaints. The law distinctly states that health officers shall "inquire into all nuisances and other sources of danger to the public health," and that they shall act promptly, efficiently, and considerately in all matters relating to the public health. A board of health should be aggressive in its warfare against nuisances and other conditions endangering the physical welfare of the people within its jurisdiction.

4. The Public Statutes are now placed in a compact form so as to be readily understood by all. The various health laws which prior to this enactment were scattered through the pamphlet laws, making it very difficult for health officers to determine what the exact law was in a given case, are now condensed in chapters 107, 108, and 109 of the Public Statutes, embracing for the present the law covering nearly every case with which the health officer is called upon to deal.

Each section of these chapters is so specific that it cannot be misunderstood. The manner in which legal action is taken to abate a nuisance is clearly indicated. The following health laws, from the Public Statutes, will be in force on and after January 1, 1892:

PUBLIC HEALTH LAWS.

CHAPTER 107.

THE PREVENTION AND REMOVAL OF NUISANCES.

SECTION 1. The health officers of towns may make regulations for the prevention and removal of nuisances, and such other regulations relating to the public health as in their judgment the health and safety of the people require, which shall take effect when approved by the selectmen, recorded by the town-clerk, and have been published in some newspaper printed in the town, or copies thereof have been posted in two or more public places in the town. Any person willfully violating such regulations shall be punished by a fine of ten dollars for each offense.

SECT. 2. The state board of health may make, in addition to the rules and regulations of the health officers of towns, such other rules and regulations, or such amendments to existing rules and regulations, as in their judgment the public good requires; and such rules and regulations shall be enforced by the health officers of towns in the same manner as other health regulations.

SECT. 3. Health officers of towns, and each of them, shall inquire into all nuisances and other causes of danger to the public health, and whenever they shall know or have cause to suspect that any nuisance or other thing injurious to the public health is in any building, vessel, or inclosure, they shall make complaint under oath to some justice, who shall issue a warrant directed to them to search such building, vessel, or inclosure; and they may in the daytime forcibly enter therein and make such search.

SECT. 4. They may notify the owner or occupant of any building, vessel, or inclosure to remove or destroy any nuisance or other thing therein deemed by them, on examination, to be injurious to the public health, within a time limited; and in case the owner or occupant, after such notice in writing, given to him or left at his abode, shall neglect to comply therewith, the health officers may forcibly enter

such building, vessel, or inclosure and cause the nuisance or other thing to be removed or destroyed.

SECT. 5. They may employ such assistants and laborers as may be necessary, and if resisted shall have the same powers as sheriffs have to command assistance; and any person willfully resisting them, or their assistants or laborers, in making the search or removing the nuisance or other thing, shall be imprisoned not exceeding twelve months, or fined not exceeding five hundred dollars.

SECT. 6. When the owner of a building, vessel, or inclosure is unknown to the health officers, or does not reside in town, and the same is unoccupied, or the occupant is, in their opinion, unable to remove the same, they may, without previous notice, immediately cause the nuisance or other thing by them deemed injurious to the public health found therein to be removed or destroyed.

SECT. 7. The owner or occupant of a building, vessel, or inclosure shall be liable to pay the expense of the removal or destruction of the nuisance or other thing, including the fees of the health officers who order or cause the same to be removed; and the same may be recovered by action brought by the health officers in the name of the town.

SECT. 8. No person shall occupy, lease to any other person, or permit any other person to occupy, a building or any part of a building within the compact part of a city or town as a dwelling-house, office, store, shop, or sleeping apartment unless such building shall be provided with suitable privies and vaults properly ventilated and constructed, and kept in proper sanitary condition, and in case of occupancy as a dwelling-house, unless it shall be provided with suitable drains or sewers for conveying the sink-water away from the premises into some public sewer, if there be one within one hundred feet thereof, and if not, for conveying it away under ground or in some other way that will not be offensive.

SECT. 9. Any person neglecting or refusing to comply with the provisions of the preceding section shall be fined not exceeding ten dollars for each day of neglect or refusal, after notice as provided in section four of this chapter.

SECT. 10. No house of easement or privy, and no pen or sty for swine, shall be erected or continued in such place or condition as, in the judgment of the health officers, to be a nuisance or injurious to the public health.

SECT. 11. The health officers may in writing order the discontinu-

ance of any such nuisance; and may order that a privy located within one hundred feet of a public sewer shall be connected therewith. If any person shall continue the nuisance after such order from the health officers, or shall neglect to comply with an order made under the provisions of this section, he shall be fined not exceeding ten dollars for each day of such continuance or neglect.

SECT. 12. If a person shall place, leave, or cause to be placed or left, in or near a highway, street, alley, public place, or wharf, or shall allow to be exposed, unburied, any animal or other substance liable to become putrid or offensive, or injurious to the public health, he shall be fined not exceeding twenty dollars; and the health officers shall remove the same.

SECT. 13. If a person shall place, leave, or cause to be placed or left in or near a lake, pond, reservoir, or stream tributary thereto, from which the water supply for domestic purposes of a city, town, or village is taken, in whole or in part, any substance or fluid that may cause the water thereof to become impure or unfit for such purposes, he shall be fined not exceeding twenty dollars, or be imprisoned not exceeding thirty days, or both.

SECT. 14. The board of health of the town or the water commissioners having charge of the water supply, or the proprietors thereof, may remove such substance or fluid; and they may recover the expense of removal from the person who placed the same or caused it to be placed in or near the water as aforesaid, in an action on the case.

SECT. 15. If a person shall use or occupy a building or place near a dwelling-house or schoolhouse, or in the compact part of a town, for a slaughter-house, a place of deposit of green pelts or skins, or for trying tallow, currying leather, or carrying on any other business that is offensive to the public, without the written permission of the health officers of the town, he shall forfeit ten dollars for each month such building or place shall be so used or occupied, to be recovered for the use of the town.

SECT. 16. The health officers may withdraw the permission by notice in writing, whenever in their opinion such use or occupancy of a building or place becomes a nuisance. In such case they shall order the abatement of the nuisance and the discontinuance of the use or occupancy within a time limited. If the owner or occupant neglects to comply with the order, he shall forfeit five dollars for each day he so neglects or refuses after the expiration of the time limited, for the use of the town.

SECT. 17. Whenever any well, spring, or other water supply is suspected of being polluted by sewage or other matter dangerous to health, the health officers of the town where it is located may cause an analysis of its water to be made by a competent chemist, without expense to the owner. If the analysis shows the water to be unfit for drinking purposes, they may, with the approval of the state board of health, prohibit its use, and, if it be from a well, may cause the well to be closed. The state board of health shall authorize such investigations whenever deemed necessary for the public good.

SECT. 18. Whenever a building, tenement, or room occupied as a dwelling or schoolroom, or any cellar or other appurtenance connected therewith, has become the source of danger to the health of its occupants or others from want of cleanliness, the health officers may order the owner, his agents, or the occupants, or any of them, to cleanse and put the same in sanitary condition, and the occupants to quit the same, within a time limited. If the persons so ordered do not cleanse the same as ordered, the health officers may do so, and may recover the expense thereof, together with their fees, of the owner, or they may order the same to be closed and to remain so until properly cleansed. If any person shall fail to comply with an order of the health officers made under the authority of this section after receiving due notice thereof, he shall forfeit ten dollars for the use of the town, or be imprisoned not more than thirty days.

SECT. 19. Health officers of towns shall furnish the state board of health such information concerning their work as may be called for from time to time, and shall forward to the state board of health copies of all rules and regulations issued by them, immediately after the issue.

SECT. 20. They shall be paid by the town a reasonable compensation for their services, and all expenses incurred by them in the performance of their duty; and the selectmen are required to advance them such sums as may be necessary, of which and of all their receipts and disbursements they shall, before each annual town-meeting, render an account to the selectmen, to be laid before the town.

CHAPTER 108.

IMPROVEMENT OF LOW AND SWAMP LANDS FOR THE BENEFIT OF THE PUBLIC HEALTH.

SECTION 1. Selectmen, upon petition, may cause any low or swamp lands within their town to be drained or filled when the public health

or good requires it, and may lay out and take such land, easements, or rights in land as may be necessary for the purpose.

SECT. 2. The procedure and return in such case shall be the same as in case of the laying out of highways; and all parties whose interests are affected thereby shall have the same remedies as they would have if their land, easements, or rights had been taken in the laying out of a highway.

SECT. 3. In awarding damages to the owner of any land, easement, or right taken for such purpose, there shall be allowed, by way of set-off, the benefit, if any, to the property of the owner by reason of the improvement.

SECT. 4. The selectmen may assess upon persons whose lands receive special benefit from such improvements, their just share of all expenses incurred in making them.

SECT. 5. Such assessments shall have the same effect, may be abated or corrected, and shall be collected in the same way as in case of assessments for sidewalks and sewers.

CHAPTER 109.

SMALL-POX AND PESTILENTIAL DISEASES.

SECTION 1. The selectmen of a town, whenever in their opinion the health of the inhabitants of the town, by reason of the spreading of the small-pox, shall require it, may appoint an agent for vaccination, who shall be provided at all times with suitable matter for communicating the kine pox. He may vaccinate all persons at the expense of the town who have not had the small-pox or the kine pox, and shall receive a suitable compensation therefor, to be paid by the town.

SECT. 2. The health officers may remove any person infected with the small-pox, the malignant cholera, or other malignant pestilential disease, to some suitable house provided by them for that purpose, if it can be done without endangering the life of the person; and they may make such regulations respecting such house and for preventing unnecessary communication with such persons or their attendants as they may think proper. If any person shall willfully violate the regulations he shall forfeit fifty dollars, to be recovered by the health officers in the name of the town.

SECT. 3. It shall be the duty of every physician who attends upon any person infected with the small-pox, the malignant cholera, diphtheria, scarlet fever, or other malignant pestilential disease, immediately

to report the same to the health officers or to the selectmen of the town. If any physician shall neglect so to do, he shall forfeit the sum of one hundred dollars, to be recovered by the health officers or selectmen in the name of the town.

SECT. 4. If any person shall, with intent to communicate the small-pox, bring into this state or use any infectious matter, or shall inoculate himself or any other person with the small-pox, or be inoculated therefor, he shall incur a penalty of one hundred and fifty dollars, to be recovered by any person who will sue for the same, one half to his own use and the other half for the use of the town in which the offense is committed.

SECT. 5. If any person shall break out with the small-pox, and the health officers shall judge that he may remain without endangering others than his own family, they may give license to persons who have been exposed to the danger of taking the disease to be inoculated and to remain in the same house, subject to such regulations as they may impose.

SECT. 6. The sum of five thousand dollars is appropriated as an epidemic fund, to be used, if necessary, under the direction of the governor and council, in case of the invasion or threatened invasion of cholera or other epidemic disease in this state.

CHAPTER 112.

DISEASES OF DOMESTIC ANIMALS.

SECTION 1. The governor is authorized to accept on behalf of the state the rules and regulations prepared by the commissioner of agriculture under and in pursuance of section three of an act of congress approved May 29, 1884, entitled "An act for the establishment of a bureau of animal industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and to co-operate with the authorities of the United States in the enforcement of the provisions of such act.

SECT. 2. The inspectors of the bureau of animal industry of the United States shall have the right of inspection, quarantine, and condemnation of animals affected with any contagious, infectious, or communicable disease, or suspected of being so affected, or that have been exposed to any such disease; and for these purposes are authorized and empowered to enter upon any ground or premises. They shall have power to call on sheriffs, constables and peace officers

to assist them in the discharge of their duties in carrying out the provisions of said act of congress; and it is made the duty of said officers to assist them when so requested. The inspectors shall have the same powers and protection as peace officers while engaged in the discharge of their duties.

SECT. 3. All damages and expenses incurred under the preceding sections shall be paid by the United States, and in no case shall this state be liable for any part thereof.

SECT. 4. The secretary of the state board of agriculture, the master of the New Hampshire state grange of the patrons of husbandry and the secretary of the state board of health for the time being shall constitute a board, to be known as the state board of cattle commissioners. If a vacancy in the board shall occur, the governor, with the advice of the council, shall fill it by appointment, and the appointee shall hold office until the vacancy in the office occasioning the vacancy in the board is filled.

SECT. 5. The board shall make investigations in regard to the existence of contagious and infectious diseases among domestic animals within the state, and may make regulations prohibiting the introduction into the state of animals so diseased, and controlling or prohibiting their transportation, and such other regulations as the board deems necessary, to exclude or arrest any such disease, and may modify or amend its regulations as the circumstances may require.

SECT. 6. The board may employ skilled veterinarians and agents and servants to aid in the performance of the duties assigned to the board.

SECT. 7. Any person or corporation who shall violate any of the regulations of the board shall be fined not exceeding one hundred dollars.

SECT. 8. The compensation and expenses of the board shall be audited and fixed by the governor and council, and shall be paid from the state treasury, but all expenses incurred under the provisions of this chapter shall not exceed ten thousand dollars in any one year.

SECT. 9. Selectmen shall cause all horses infected with glanders or other contagious disease, and all other domestic animals infected with contagious diseases, or which have been exposed to such diseases, to be collected in some suitable place or places and kept isolated from other animals so long as may be necessary to prevent the spread of the diseases.

SECT. 10. In the performance of the duties prescribed by the preceding section the selectmen shall be governed by the regulations and

directions that may be made or given on the subject by the state board of cattle commissioners.

SECT. 11. The state board of cattle commissioners, or if they have not taken cognizance of the case, the selectmen of the town in which the animal is, may order any domestic animal killed and buried which in the opinion of a veterinary surgeon, selected by them, has a contagious or infectious disease.

SECT. 12. The owners of animals so killed shall be entitled to recover of the town the value of such animals in their diseased condition, if they had been owned in the state three months at least before the disease was detected. The state board of cattle commissioners or the selectmen, as the case may be, shall cause the value to be ascertained by the appraisal of three competent and disinterested persons selected by them, who shall be sworn to the faithful discharge of their duties.

SECT. 13. In case the owner is aggrieved by the appraisal, he may appeal by petition to the supreme court within thirty days after he is notified of the appraisal. He shall notify the town of his appeal, and enter and prosecute it, as he would if it were a civil action at law, wherein the same amount of damages was claimed; and judgment shall be rendered therein in like manner.

SECT. 14. If, upon such appeal, he recovers a larger sum than the appraisers awarded him, he shall recover his taxable costs; otherwise he shall pay costs.

SECT. 15. All damages and expenses incurred under the preceding sections, except expenses incurred by the state board of cattle commissioners shall be paid by the town in the first instance; but four fifths thereof shall be reimbursed to it from the state treasury. The governor and council shall audit all claims thus presented, and the governor shall draw his warrants upon the treasurer for the amounts allowed, in favor of the towns entitled thereto.

SECT. 16. In cases where United States inspectors, state commissioners, and selectmen, or any two of such boards, take action with reference to the same subject-matter under the provisions of this chapter, they shall have precedence in authority in the order above named.

SECT. 17. Any person or corporation who shall bring into the state, between the twentieth day of May and the twentieth day of October, any Texas or Cherokee cattle that have not been kept north of the Ohio or Missouri river during the winter immediately preceding, shall be fined not exceeding twenty-five dollars for each animal so brought into the state. The term Texas or Cherokee cattle shall be con-

strued to mean the native cattle of Texas and Louisiana and the classes of cattle known under those names.

SECT. 18. Any person who shall expose or suffer to be exposed, in any highway, public place, or pasture any horse affected by the disease known as glanders, shall be fined not exceeding fifty dollars for each offense, for the benefit of the town or city where the offense is committed.

SECT. 19. Any person exposing any domestic animal as aforesaid, affected with any other contagious or troublesome disease, shall be fined not exceeding twenty-five dollars for each offense, for the benefit of the town.

SECT. 20. It shall be the duty of selectmen and police officers of towns in which any of the offenses mentioned in the three preceding sections shall be committed, to cause the offenders to be prosecuted.

CHLORINATED LIME AS A HOUSEHOLD DISINFECTANT.

BY JOHN J. BERRY, M. D., MEMBER OF THE STATE BOARD OF HEALTH, PORTSMOUTH, N. H.

No problem of greater importance confronts us from day to day than the effective disinfection of the sick room. Not because of the want of proper agents, but rather by reason of their great number and the confusion existing in the minds of many regarding their application. It is not surprising that such should be the case, for the fact is generally admitted that the germs of infectious diseases are of a most varied character, each possessing its own characteristics as regards development, propagation, and tenacity of life. Hence, an agent which readily attacks and promptly destroys the germ of one disease may prove wholly inefficient in reaching and removing that of another. To the physician or trained nurse the attainment of the desired results is a matter of little difficulty, but to the large class of people among which the various infectious diseases are specially prevalent and fatal, the details of practical disinfection form an unlearned science. It is, indeed, this lack of definite knowledge which has proven the most serious obstacle in the path of sanitary advancement.

It will be readily admitted that the intelligent use of a single disinfectant is productive of far better results than the careless and indifferent use of two or three simultaneously; in fact, the attempt to apply a special germicide to each particular case has in most instances proven a decided failure.

In view of these facts, it has seemed to us that some single agent which is cheap, harmless, effective, and readily applied, might be recommended almost exclusively — its proper employment being thoroughly explained and insisted upon.

Chlorinated lime probably possesses these qualifications to a greater degree then any other disinfectant and germicide, hence should be, in our opinion, the one generally advocated. This substance, commonly known as "Chloride of Lime" or "Bleaching Powder," is a white, dry powder, having a saline taste and a slight odor. It contains from 20 to 30 per cent of free chlorine to which its active properties are due. For this reason it is a somewhat unstable compound, being readily decomposed and setting free its chlorine in the presence of moisture, carbonic acid, the carbon dioxide of the air, and all organic material with which it may come in contact; hence, its action is more prompt than that of any other disinfectant. Its trifling cost, which is not over five cents a pound and even less in larger quantities, is another advantage, permitting its free and prolonged use by those unable to procure the more expensive and perhaps less effective agents.

This substance exerts a powerful action, not only as a disinfectant and deodorizer but also as a germicide. In a series of experiments conducted by the "Committee on Disinfectants," of the American Public Health Association, its properties were thoroughly investigated and these several characteristics fully demonstrated. It was shown that a solution of chlorine containing one part of the hypochlorite to 400 of water, was an effective germicide, even when allowed to act only one or two minutes. One of six parts to 10,000 was found to kill in two hours the spores of the bacillus anthracis, a disease germ most virulent in its action and most difficult to destroy. A similar result was attained by careful experimentation regard-

ing its power to disinfect fecal matter. For these reasons, we may be fully assured of its efficacy in typhoid fever, diphtheria, and the ordinary contagious diseases, when employed in proper proportions. A like action may be noted whenever an infected atmosphere is treated by the same agent. In the presence of moisture, dry anthrax spores are killed by exposure for one hour to air containing 4 per cent of chlorine, while vaccine lymph loses its infectious properties in the presence of a one per cent vapor of the same. Hence, chlorinated lime has been recommended by the latest authorities as being, in a large proportion of cases, the best disinfectant known.

PRACTICAL APPLICATIONS.

Chlorinated lime may be used in its dry state or, better still, in solution. The latter can be prepared by dissolving six ounces of the powder in a gallon of soft water, forming what may be termed the "standard solution." This should be kept in clean air-tight receptacles until used.

There is probably no better method of treating infected clothing than by exposing the same to steam or other form of intense heat. Hence, all such material should first be boiled continuously for an hour. This promptly destroys all disease germs and their spores and thus removes all danger from these sources. While there are a few of these organisms which resist for a few minutes a temperature of 212 F., the great majority succumb to a degree of heat not exceeding 140 F. It should be remembered, however, that large and compact bundles of clothing placed in the boiler, are not equally disinfected; for while the temperature of the external portions may be sufficiently high, that of the centre may be scarcely up to the boiling point. Should it be impossible to carry out this plan at once, the infected material may be placed in the standard solution, diluted with three or four parts of water, or else gathered into one mass and enveloped in a covering saturated with the same. The use of the solution should follow rather than precede the process of boiling, for, by having the clothing comparatively clean and free from organic matter, a

weaker solution and a less prolonged application of the same is required. The use of this agent has been frequently objected to on account of its bleaching action upon woolens, colored goods, and those of delicate texture. Material such as these, however, should be used as little as possible in the sick room, but if used, should be disinfected by heat alone; whereas, upon ordinary white goods a solution of the strength demanded can have little if any destructive action. The above methods are usually supplemented by the process of ironing, which, on account of the steam developed, is in itself of some germicidal value.

In many, if not all the infectious diseases, the waste products eliminated by the lungs, kidneys, bowels, skin, and mucous membranes possess poisonous properties which contaminate everything with which they come in contact and may, either immediately or at some future time, reproduce themselves. It is important therefore, that they should be at once deprived of these elements of danger. Nothing will accomplish this result better than chlorinated lime, which for rapidity of action so much exceeds all other agents. The dejections of patients suffering from infectious diseases, especially typhoid fever, should be treated for an hour with the standard solution, from 2 to 3 quarts being used for each evacuation. As its active principle, the hypochlorite, is quickly decomposed in the presence of all organic matter, it should always be present in excess of the amount of material to be disinfected. As regards large amounts of excreta, as for example, the contents of vaults and cesspools, there is no method by which they can be thoroughly sterilized. The belief that the poisonous elements of such collections may be destroyed by any powerful agent applied to their surfaces, is both a false and dangerous one. Certain ones have greater powers of penetration than others but no substance can exercise such action unless brought into direct contact with the objectionable material. When this can be accomplished, about one pound of lime powder will properly disinfect about 30 pounds of solids. This may be applied in solution or sprinkled thickly over the surface to be

purified. The secretions of the nose and throat, which in diphtheria are extremely poisonous, should be received into vessels containing the freshly made solution, or upon cloths or handkerchiefs which should be promptly destroyed. A gargle of the same, diluted with four or five parts of water may also be used frequently as a precautionary measure.

The skin, which in scarlet fever particularly, and in many other affections to a less degree, is a frequent source of infection, should receive no less attention. A lotion of the same strength, to which Listerine, cologne, Florida water or other toilet preparation has been added, forms an effective as well as agreeable application which may be used freely in all febrile conditions without injury to the skin. When desquamation of the cuticle occurs, as in scarlet fever, the use of the above should be supplemented by the inunction of oil.

The latest and best appliances for sewage disposal will at times prove sources of danger unless subjected to careful and intelligent supervision. However thorough the removal of such material may be, the traps and pipes become after a time, foul and offensive and perhaps clogged with organic matter. The first step in the process of cleansing is the preparation of a hot saturated solution of washing soda or, better still, caustic soda, which should be poured down the pipes in sufficient quantity to about fill the traps. The alkali, if allowed to remain for several hours, unites with the greasy deposit and forms a soap which is readily washed out by the free use of hot water. The subsequent employment of the standard solution in sufficient quantities renders the disinfection complete.

Sewers and drains which are constructed of wood and are otherwise faulty, cannot be thoroughly purified, yet their frequent flushing and the use of the solution in generous quantities affords the best plan we know of for keeping them in the best condition possible. The facility with which this agent decomposes the sulphuretted hydrogen compounds and other gaseous bodies, renders it equally valuable as a deodorizer in this as well as all other cases where several indications are to be met.

Neither this nor any other agent can be relied upon solely for the disinfection of the sick room. Fresh air and cleanliness rank highest as purifying agents; all others are merely adjuvants. We can accomplish far more by diluting and changing the atmosphere of an infected room, than by trying to destroy its germs by some disinfecting substance; in fact, the latter alternative must necessarily prove futile, for the air of any enclosed space impregnated with such an agent in sufficient quantities to prove germicidal, would become at once uninhabitable. Yet a small quantity of the solution exposed to the air by means of three or four towels dipped in the same, acts as a prompt and effective deodorant, if nothing more.

While then no apartment in constant use can be completely disinfected, much can be done in this direction by a frequent washing of the floor, paint, woodwork, and furniture with a diluted solution of the lime, one part to three being a proper proportion. This, together with the other methods above advocated, will maintain any living room in about as perfect a condition as it is possible to secure.

While there are other agents, such as carbolic acid, corrosive sublimate and permanganate of potash, which in certain cases are superior to chlorinated lime, we believe there are none which for general utility, can be compared with it.

Chief among its virtues may be noted the following:

1. Moderate cost.
2. Facility of application.
3. Rapid action.
4. Decided germicidal powers.
5. Marked deodorant properties.
6. Non-poisonous qualities.
7. General adaptability.

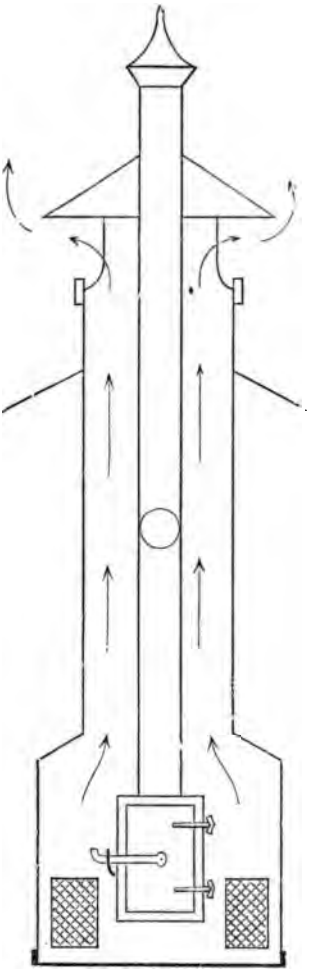

FIG. 4.

This is made of corrugated galvanized iron with a stove inside. They claim it is cheaper than a brick shaft, but there is a constant expense to run an extra stove.

I think a draft could be created in the outgoing flue in a

in contact with the practical application of sanitary law. The principles on which they work and their operation should be fully explained to them and their importance impressed on their minds. When he sees these principles carried out and enforced in the daily discipline of the school, they will influence his after life, and we shall see his own private dwelling constructed according to the laws of health and his private and social life be under the same rule of action.

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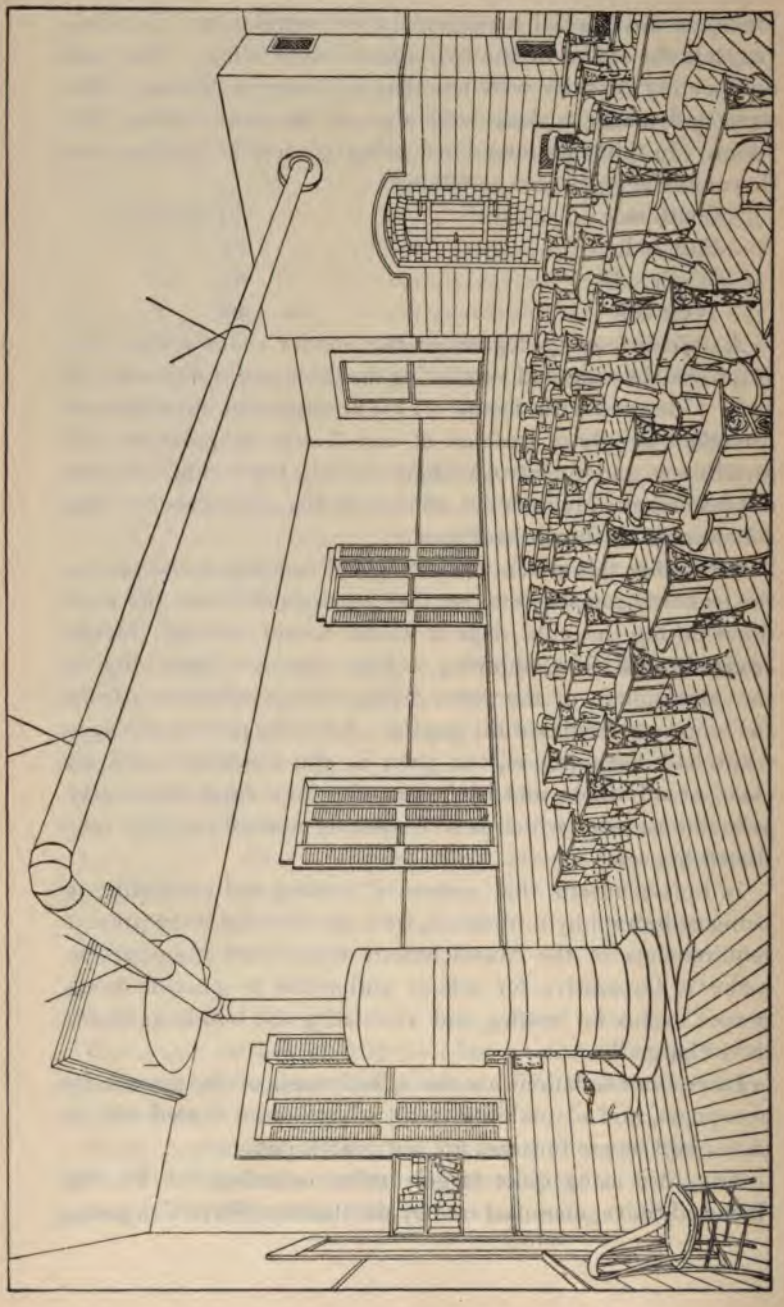

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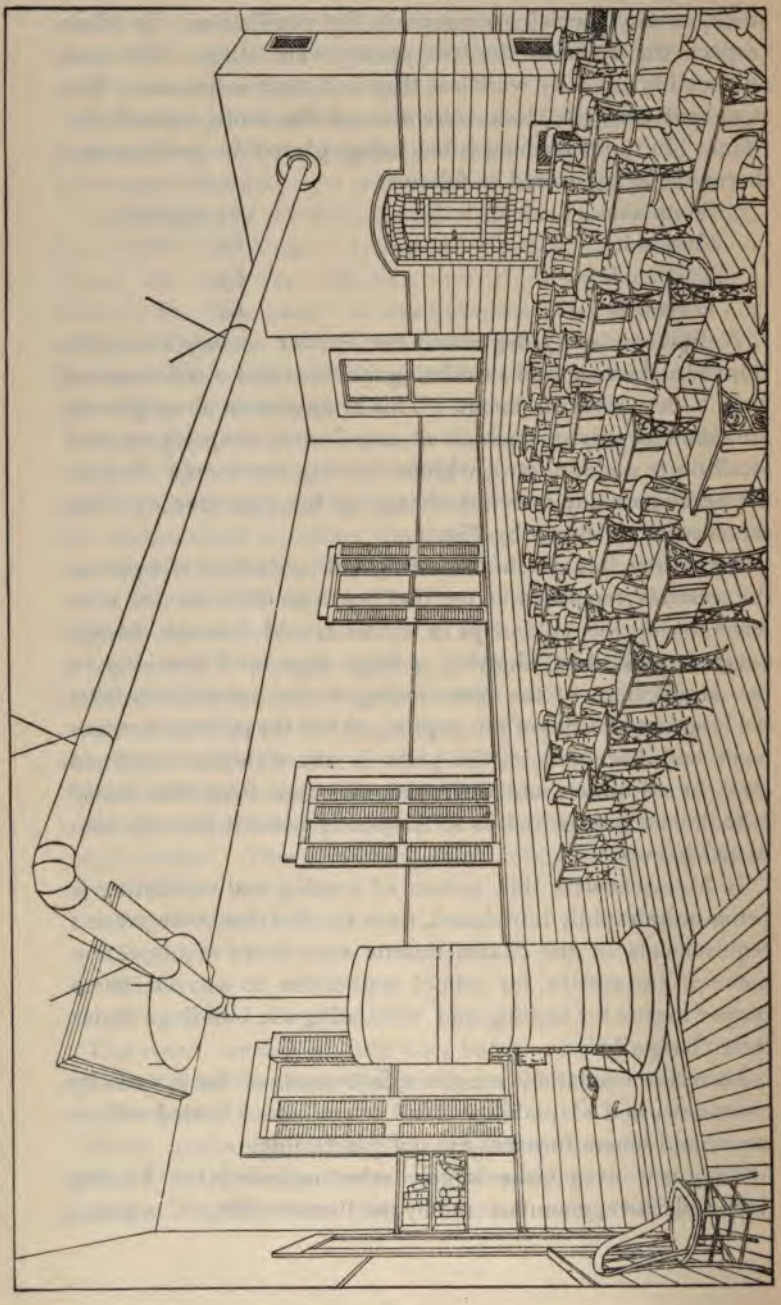

FIG. 1.

OUR COMMON SCHOOLS.

BY D. M. CURRIER, M. D., NEWPORT, N. H.

It has been said that "the crowning glory of our civilization is our common schools," and for this reason we should never tire of doing our utmost to promote their usefulness.

In the effort to improve the social, moral, or religious well being of a people, reformists at the present time recognize in the plastic minds of childhood and youth their best field of operation.

Temperance reformers have been working away on their much hackneyed subject for a century. For a long time not a passing thought was given to those millions who were pressing on to take the place of the fallen. In due time, however, the strength of the gigantic evil was discovered; and now, those organizations are endeavoring to starve it into inanition by temperance instruction to the young, and by securing laws in most of the States requiring such instruction to be given in the common schools. In our efforts as sanitarians to improve the physical well being of the State, we may well copy after the reformist.

Our efforts receive more or less opposition from lack of intelligence on the subject among the common people. "How best to educate the people in public hygiene is the most important question in relation to public health." Much has been done in the last few years by state and local boards of health to disseminate sanitary knowledge among the people, and where they have fully understood the importance of a change they have been willing workers to that end.

We are living, however, for the future generation. The question we may well ask ourselves is, how can we make that generation better, wiser, and more vigorous than ourselves. To accomplish this we should not build too much from the top, but start from the beginning and build from the foundation.

The pupils in our common schools should be brought daily

in contact with the practical application of sanitary law. The principles on which they work and their operation should be fully explained to them and their importance impressed on their minds. When he sees these principles carried out and enforced in the daily discipline of the school, they will influence his after life, and we shall see his own private dwelling constructed according to the laws of health and his private and social life be under the same rule of action.

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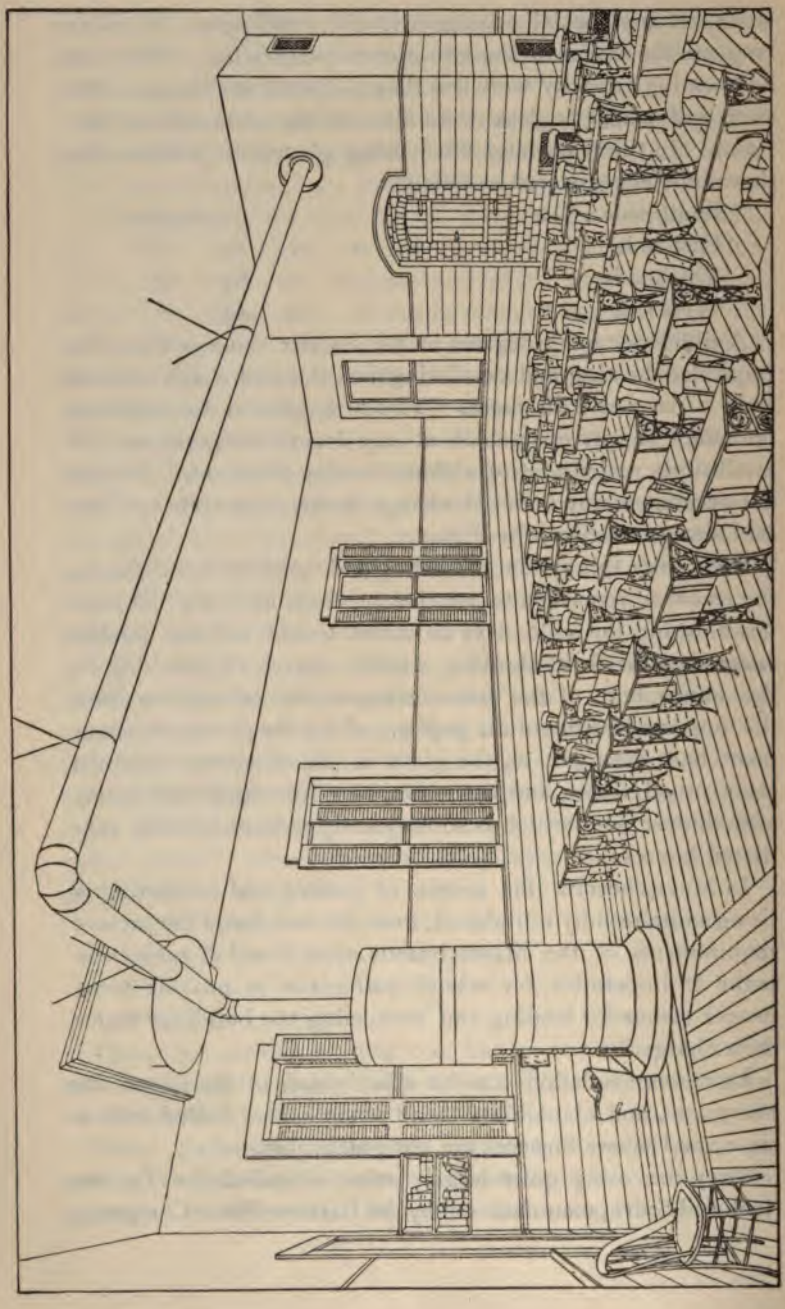

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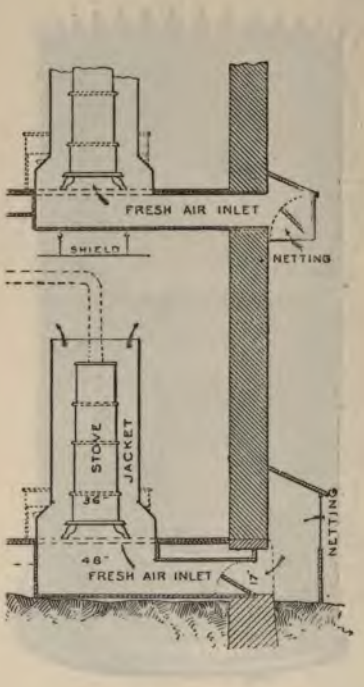

FIG. 3.

The suggestion is made to have the incoming duct open from both sides of the house and provided with proper dampers, thus affording an opportunity to obtain a supply of air from the windward side of the building, and to regulate the amount of air supplied to the jacket around the stove.

To facilitate the passage of impure air from the room, the company provides a heated flue as represented by Fig. 4.

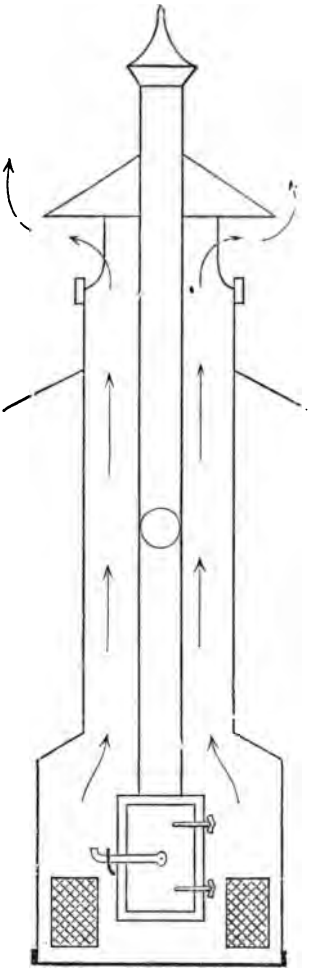

FIG. 4.

This is made of corrugated galvanized iron with a stove inside. They claim it is cheaper than a brick shaft, but there is a constant expense to run an extra stove.

I think a draft could be created in the outgoing flue in a

different way and with no additional expense above first cost. Build a shaft large and from the ground, with an opening on a level with the floor. I would then have the smoke flue from the stove pass into this and continue through its centre to the top, depending upon the heat it produces to cause a draft.

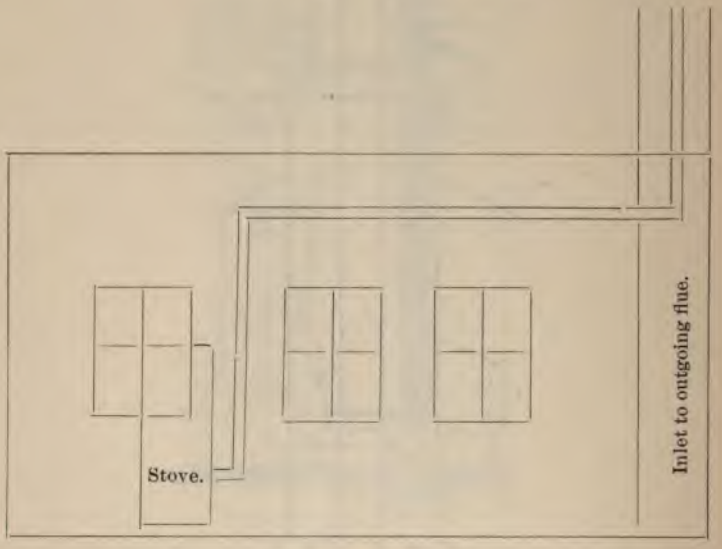

FIG. 5.

Nothing new is claimed by this system of heating and ventilating our common schoolhouses, but it has proved itself so admirably adapted to the demands, equally heating the whole room and removing the impure air, without the danger and discomfort of cold drafts from open doors or windows, we wish it would be more generally adopted.

We believe the interest of the common schools of America should be continually in the minds of the whole people, that no expense or care is too great to make them as they have already been called, "the divinest thing on earth."

THE SEWERAGE OF TWO NEW HAMPSHIRE TOWNS.

BY GEO. E. WARING, JR., M. INST., C. E., NEWPORT, R. I.

It may be of interest to the readers of the report of the Board of Health in New Hampshire to be informed as to the sewerage of Keene and of Laconia, works which have been carried out on a system materially different from what had before been used in this State; this being the same system that was introduced in the city of Memphis, Tennessee, after the yellow fever epidemic of 1878–9.

It is a peculiarity of this system that it is used for the removal of foul sewage only, no rain water being admitted either from the surface of the ground or from the roofs of houses. The sizes of the sewer pipes are proportioned to the limited but uniform work of removing the daily foul waste of houses and manufacturing establishments. The lateral sewers, constituting a very large proportion of the system, are only six inches in diameter. When enough building lots have been passed to make the future maximum flow of sewage sufficient to fill a sewer one half full, its size is increased to eight inches, which about doubles the capacity on moderate grades. When the eight-inch sewer would run as much as half full, an increase is made to ten inches, of which the capacity is about 60 per cent more than that of the eight-inch. As no rain water is admitted for the flushing of the sewers, it becomes necessary to substitute other means for keeping them clean. This is done by placing at the head of each sewer, below the surface of the street, a small cistern, called a flush-tank, and holding, when full to the level of its discharging point, about 150 gallons of clean water admitted from the water supply in a very small dribbling stream, sufficient to fill it about once in twenty-four hours. When it becomes filled, an automatic siphon is brought into operation, discharging the whole volume suddenly in a strong flushing

confinement is working them bodily harm. Thirty-five thousand six hundred and fifty-eight of the best part of our population, those upon whom the hope of the State is placed and the destiny of its future depends; those of that tender age when external influence and unsanitary surroundings will have the most damaging and lasting effect, are left without that medical care which is given to the outcasts of society in our state prisons.

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* In a former paper on the "Sanitary Conditions of School Life," vol. 7, it was shown that badly ventilated schoolrooms were a direct cause of myopia.

would be placing the physician in his truer and nobler position, that of a guardian of the public health and the prevention of sickness rather than curing it.

As the proper ventilation of our schoolhouses is of prime importance I wish to supplement these rambling and much interrupted thoughts by a few words on the subject.

In the report of the State Board of Health for the year 1888, Vol. VII, I explained a system of heating and ventilation which has been very effective and given good satisfaction where it has been used. It was introduced into several of our village schools in 1887. The system consists briefly of a jacketed stove with an inlet duct coming from outside and opening upward through the floor under the stove.

An outgoing duct was constructed on the opposite side of the room from the stove, extending up through the top of the building, with an opening on a level with the floor. We find this arrangement equalizes the temperature of the room to a remarkable degree, as indicated by the following observations taken October 28, 1891. The temperature outside was 31 degrees F. At 10 o'clock A. M. visited our south primary school, which was in session. In this schoolroom the jacketed stove has been in use for four years. The stove was on the south side of the room near the teacher's desk. The outgoing flue was on the north side, directly opposite. Four thermometers were placed on the four sides of the room about equal distances from the corners and a little higher than the pupils desks. After remaining thirty minutes they registered as follows:

South side	62 degrees.
East side	60 "
North side	60 "
West side	61 "

The room seemed a little cool but no one appeared to be suffering from the low temperature. The fire in the stove was very low.

Went immediately from this school to the east primary, and at 11 A. M. made the same observations as at the south primary. In this room they were not using the jacketed

stove nor any special arrangement for ventilation. In other respects the stoves in the two rooms were alike. The size and seating capacity were less than in former instances. The stove and teacher's desk were also on the south side of the room. In thirty minutes after being placed in position the thermometer registered as follows:

South side	74 degrees.
East side	61 "
North side	65 "
West side	65 "

A difference of 13 degrees in the smaller room without the improved heating and ventilating facilities and a difference of only 2 degrees with them. This arrangement furnishes an abundant supply of fresh air at any desired temperature, and at all times under control without leaving the room. It does not necessitate any material change in the appearance of the schoolroom as shown by Fig. 1.

Soon after this system of heating and ventilation was put in, the teachers remarked to me that previous to its use the windows during the cold days in winter would become thickly covered with frost, showing a high degree of humidity in the atmosphere of the room owing to the exhalations from the lungs and bodies of the pupils. After the present arrangement had been put in, the glass in the windows remained clear at all times, and the room was free from that musty schoolhouse odor which is so frequently noticed in badly ventilated houses.

In Massachusetts this system of heating and ventilating is being quite rapidly introduced, from the fact that "the present requirements of the Massachusetts state board of inspection make it imperative for school authorities to provide some proper means for heating and ventilating the buildings under their charge."

Its recommendations are the effectiveness of the system, its cheapness, and adaptability to all schoolhouses heated with a stove, and where furnaces are not practicable.

They are using quite largely what is called the Puritan Jacketed Stove, manufactured by the Barstow Stove Company.

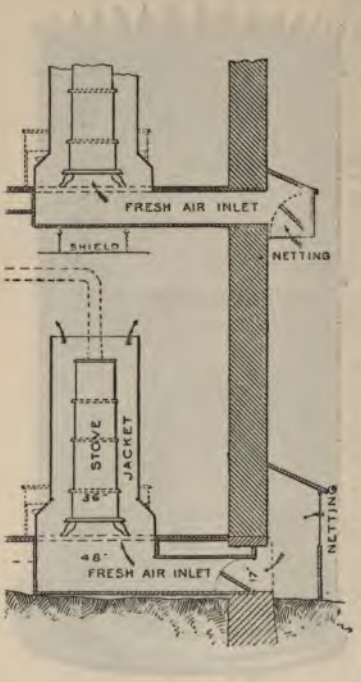


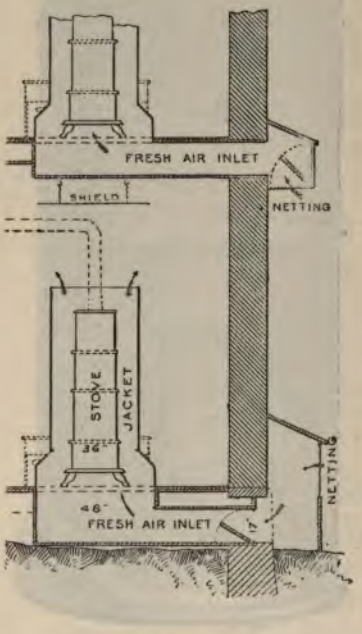
FIG. 3.

The suggestion is made to have the incoming duct open from both sides of the house and provided with proper dampers, thus affording an opportunity to obtain a supply of air from the windward side of the building, and to regulate the amount of air supplied to the jacket around the stove.

To facilitate the passage of impure air from the room, the company provides a heated flue as represented by Fig. 4.

FIG. 2.

These stoves shown in Fig. 2 " are eighteen inches in diameter and are surrounded by a jacket made of No. 24 crimped, galvanized iron thirty-six and a half inches in diameter, thus having a space of about nine inches around the stove except at the door, where a suitable recess makes tight joints. This jacket is connected by an opening 12 x 20 inches which comes from outside of the building, the inlet in lower stories being four or five feet from the ground and covered with a netting."



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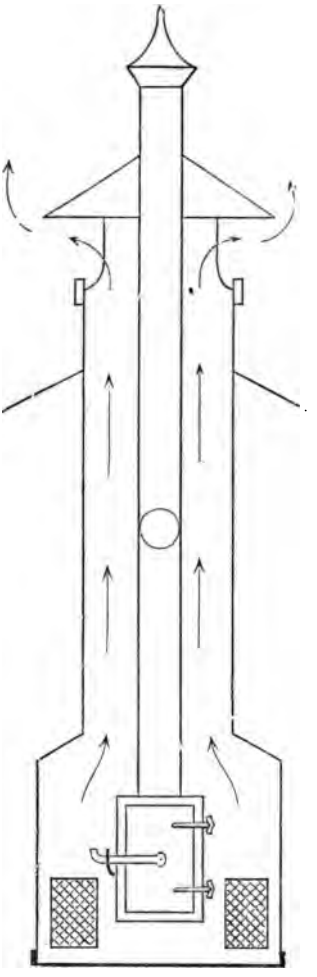

FIG. 4.

This is made of corrugated galvanized iron with a stove inside. They claim it is cheaper than a brick shaft, but there is a constant expense to run an extra stove.

I think a draft could be created in the outgoing flue in a

cut in. I am also troubled a little with roots, and everything that is made by man gets into the sewers — dish rags, bones, spoons, old aprons, skirts, newspapers, etc. I could fill a page with the different things I have found in the pipes. The balls locate partial stoppages and so prevent a full stop."

There are now, in Keene, about 800 families whose premises are connected with the sewers.

LACONIA.

The writer also made a plan for the sewerage of Laconia in 1886. The conditions here were much more difficult than they were in Keene, where the chief obstacle to satisfactory working lay in the quicksand, of which a good deal was encountered, much of the city being low and flat.

Laconia lies on both sides of the Winnipesaukee river, a stream of great volume, with a mill dam in the heart of the town, making a deep channel above with an exceedingly rapid current below, the discharge into Sanbornton bay being within the town limits. The conformation of the territory is such that it was not possible to carry all of the drainage from the area east of the river to the outlet on that side, a very considerable portion of it had, necessarily, to be carried across the river to be delivered by the main sewer of the west side. A pipe might have been suspended under the bridge crossing the river at Church street, which would have resisted the flow of the stream, that point being above the dam, but it could not have withstood the rush of logs liable at any time to be brought against it. This difficulty was overcome by making an inverted siphon of iron pipe, descending to the bottom of the river and embedded in it, and rising at the outgoing side to the level of the sewer into which it is to discharge. As this pipe will always be full and will consequently have but a sluggish current, provision has been made for keeping it clear by placing a large automatic flushtank (capacity 1,600 gals.) near the corner of River street and Arch street, in the line of the Arch street sewer. There is sufficient fall to the ground here to allow a drop in the grade

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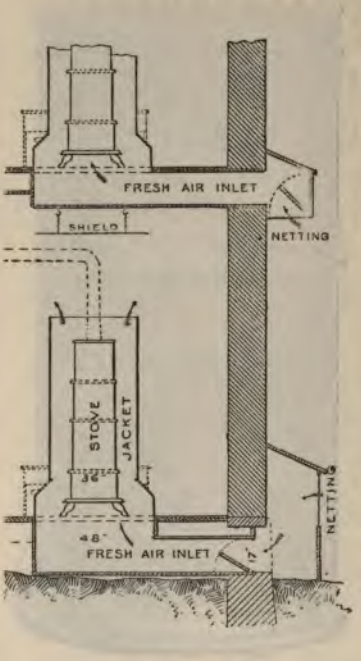

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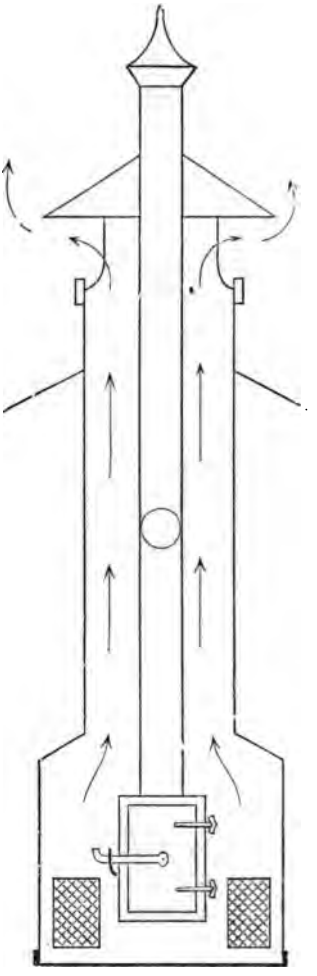

FIG. 4.

This is made of corrugated galvanized iron with a stove inside. They claim it is cheaper than a brick shaft, but there is a constant expense to run an extra stove.

I think a draft could be created in the outgoing flue in a

Laying the Siphon at the Church Street Bridge.

of 5.6 feet. The flushtank is placed at this point, receiving the entire flow from the sewer above, retaining it until full, and then discharging the whole mass in such volume and with such head as to ensure the production of a cleansing flow through the siphon, the construction of which is as follows:

It was necessary to lay the siphon at one side of the bridge on account of the mud sills interfering with its bedding if placed under the bridge. Piles four inches square were driven opposite each bent of the bridge and capped and supported. A temporary platform was built at the water level to work from, both in excavating the bottom and in leading the joints. The pipe was supported from timbers six inches square placed on top of the cap pieces. There was quite a strong current, and guides were driven at every other joint to prevent the pipe swinging out of line in lowering. The excavation was mostly sand. Clay was encountered in two places. A few small stones were encountered but these were easily removed with rakes. After the bottom was excavated, the lower staging was removed. Men were placed at the supporting ropes at each joint; a mark was made on each rope one foot from the timber, and every line was slacked off as uniformly as possible and held at the mark. This operation was repeated until the pipe rested on the bottom.

The accompanying illustration shows the pipe swung, ready for lowering. Figure 1.

Another difficulty consisted in the fact that as the lower portion of the Winnipesaukee river and the adjoining bay of the lake into which it discharges are so much used for pleasure boating ("The Laconia Navy"), it was entirely inadmissible to discharge sewage at the shore. Both outlets are carried to the deep channel where the river flows into the lake, through iron pipes, that on the east side being twelve inches in diameter and one hundred and thirty-five feet long, and that on the west side being fourteen inches in diameter and three hundred and thirty-one feet long. These pipes are laid in the sand from the shore to about the point of discharge.

The placing of the fourteen-inch outlet (Water street) is

shown in figures 2 and 3. The trench was close sheeted and it was found necessary in places to drive a board outside in order to cover the joint. Pieces of bagging were also used for the same purpose. The water was not pumped out at all but the sand was so fine in places that it ran through the smallest opening. One set of rangers was placed at the water line and the sheeting was driven about a foot below the bottom of the trench. This held it in place perfectly. The last three lengths of pipe were laid on a platform which was lowered to a pile support at its outer end. The pipe was supported in the same manner as at the other outlet and at the bridge. It was lowered nearly to the rangers at the surface of the water. These rangers were then taken out and placed above the pipe. The pipe was then lowered to grade and enough sand thrown in to bed it. The sheeting was then drawn.

Except for these peculiarities and for the use of "inspection pipes," to be described below, the system is substantially the same as that at Keene. It comprises 10.28 miles of sewers, all of pipes ranging in diameter from six inches to fifteen inches, 65 per cent of the whole being six-inch. There are forty-five flushtanks, thirty-one manholes, and eighty-two inspection pipes. The work is not yet entirely completed and exact figures cannot be given, but the amount paid under the contract will be not far from $54,000.

The work was begun July 7, 1891 and was practically completed by November 20, 1891. It was all carried out under the engineering control of Waring, Chapman & Farquhar of Newport, R. I., my partner, Mr. Chapman, being the engineer in charge.

The inspection pipes referred to above are an improvement added since the work at Keene was done. They take, very largely, the place of manholes and are placed at intervals of about two hundred to three hundred feet, average. They consist of an iron pot or chamber built at the surface of the street with an iron cover, all being strong enough to stand the concussion of traffic. This chamber which is about

15 - Inch Outlet Being Lowered.

Arrangements for Lowering the 15-Inch Outlet.

twenty inches in diameter has two oblique arms, set at an angle of forty-five degrees and pointing, one up stream and one down stream. The openings into these arms are closed by cast iron doors, held fast by an iron bar between them which is fastened in place with a Yale lock. The arms are long enough to enter the collars of eight-inch pipe, which rise obliquely toward them from the top of the sewer. The lowest pipe of this oblique connection, on six-inch sewers, reduces in size from eight-inch to six-inch and enters the branch of the sewer. By removing the cover, releasing the bar, and uncovering the arms, a straight line of sight is given into the sewer so that by throwing down the light from a bull's-eye lantern, the condition and character of the flow can be perfectly inspected.

The details of these appliances are shown in the accompanying cuts. Figures 4 and 5.

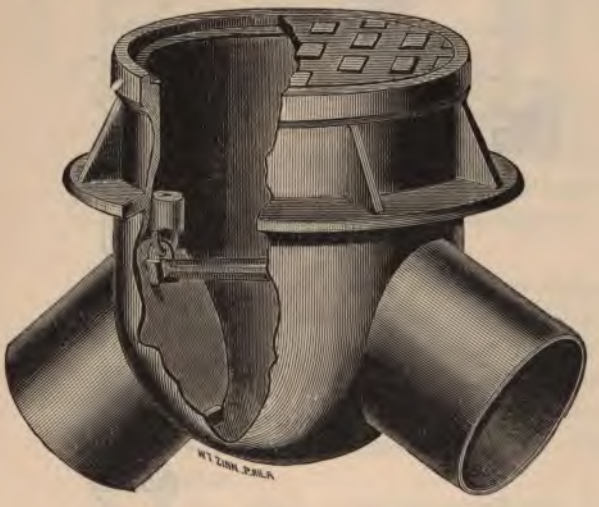

FIGURE 4.

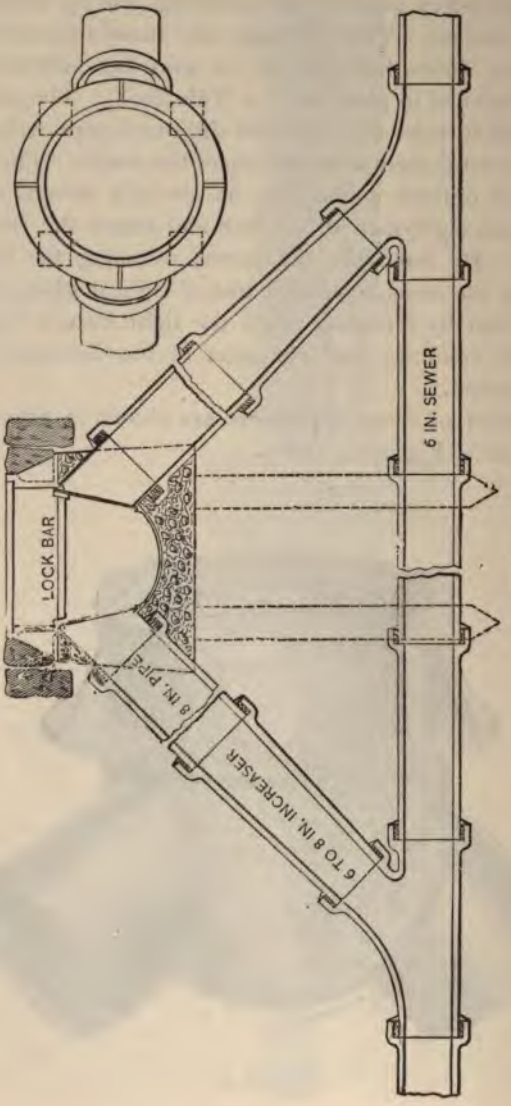

FIGURE 5.

Cords can be floated from the down-stream arm of one chamber to the up-stream arm of the next below, by which ropes may be drawn through, carrying steel brushes, or whatever other appliances may be used in cleansing. When sewers are to be cleansed by passing balls through them slightly smaller than their interior diameter, so as to produce a cleansing current as the sewage flows around the ball, a strong cord is attached to the ball by which it is kept under control until it shows itself at the inspection pipe below, where it may be pulled up, or it may be drawn back to the starting point.

In case of stoppage, the sewer may be easily plugged, through the down-stream branch of the inspection pipe next below, and then filled with a solid column of water, which being churned with a plunger from the up-stream pipe, produces a direct movement on the obstruction and sets it free. These pipes have the advantage that they make it possible to do all cleansing work from the surface of the street instead of working in the contracted quarters at the bottom of a manhole. As their openings are locked fast, one of the most serious objections to manholes, the opportunity offered for malicious persons to throw in obstructions, is obviated.

Some difficulty was caused in construction by the uncertainty as to the location of water pipes. "These were laid in the centre, at one side, or diagonally across the streets as the case might be. No record of their location was kept, and a margin of five feet from where the pipes were supposed to be, proved to be none too much.

The material used for these sewers was granite pipe, manufactured by Knowles, Taylor & Anderson of East Liverpool, Ohio. It was very satisfactory save that a considerable amount of the smaller sizes had to be rejected because it was not straight. "The bells were especially large and there was not a single pipe that required chipping." This is a great recommendation.

The joints of the pipes were inspected and carefully covered before the cement had set. Damage to be caused by jarring the pipe and cracking set cement was thus avoided.

Wherever water was encountered even to a small amount in the holes dug for the bells of pipes, the cement was held in place by a strip of muslin tied around it. Where the water was very troublesome, Stanford's joints were used with very satisfactory results.

During the whole time of construction, from July 7 to November 22, only one whole day and five half days were lost on account of rain.

The ground in which the sewers are laid is variable, some of it difficult. Much trouble was caused by unexpected caving and sliding, largely due to the proximity of old water and gas ditches near the line.

At this writing, the system is being tested by passing through all of the lines balls two inches less in diameter than the bore of the pipe. These balls are attached to cords and are flushed through from one inspection pipe or manhole to another, demonstrating the safe condition of all the work.

AMERICAN PUBLIC HEALTH ASSOCIATION.

EIGHTEENTH ANNUAL MEETING.

REPORTED BY G. P. CONN, M. D., DELEGATE FROM THE STATE BOARD OF HEALTH.

The eighteenth annual meeting of the American Public Health Association was held in Charleston, South Carolina, and there was a good attendance. The North and West being largely represented and the Dominion of Canada, as well as the Republic of Mexico were officially represented by order of their respective governments.

Morning Session, — Tuesday, Dec. 16, 1890.

The meeting was called to order at 10 o'clock A. M., the president, Dr. H. B. Baker of Lansing, Michigan, being in the chair.

The Hibernian hall was the place selected by the committee of arrangements in which to hold our meetings, a public building with which there has been associated much of a historical character and which was one of the public buildings that suffered much injury at the time of the terrible earthquake disaster in 1886, but to-day presents a beautiful object lesson of the energy, indomitable will, perseverance, and courage of the people of Charleston, for the building has been restored to its former conditions, and there is scarcely a mark to show the convulsive power that for the moment seemed ready to destroy the city.

The association after very short, formal, and routine exercises proceeded to the programme, the first paper being the Federal District in the Republic of Mexico, as a suitable residence for persons predisposed to tuberculous affection, and for the relief of pulmonary consumption, by Dr. Domingo Orvañanos, member of the superior board of health of Mexico.

The paper graphically presented the claims of this district and gave some valuable statistics and information.

"The prevention of tuberculosis; a century's supervision in Italy, under the influence of the preventive laws of the kingdom of Naples, enacted in 1782," by L. F. Flick, M. D., of Philadelphia, member of the Pennsylvania state board of health, was the next paper read. It showed a most careful investigation of the history of tuberculosis and gave some sound advice upon the necessity for cleanliness and keeping away from places in which consumption was common, as at Nice at certain seasons.

The next paper, on ventilation and impure air, as prophylactive or causative of disease, by P. C. Remondino, M. D., president of board of health, San Diego, California, was read by title.

TALKS ABOUT TUBERCULOSIS.

The last paper of the morning session was read by Dr. B. F. Wyman, of Aiken, on the prevention of phthisis. Although a short paper it was an excellent one and incidentally showed the great advantage of Aiken as a health resort of unquestioned importance. The claims of Aiken were practically presented by one who has had fourteen years of experience in the treatment of consumptives at Aiken.

Dr. Baker, president, announced that the association was ready to hear discussion upon any one of the subjects read.

Dr. Albert L. Gihon, of the United States navy, said that something ought to be done to prevent the general expectoration of consumptives on cars, vessels, and elsewhere. He hoped that if nothing else was done a committee would be

appointed to take the matter in hand. The promiscuous and liberal expectorations of those affected with tuberculosis ought to be regulated in some way. He remarked that the real object of the association is to look after the prevention of the disease, and not so much at its cure.

By request, Dr. Kemp, of Brooklyn, an expert bacteriologist, said about the spread of bacilli that the bacilli of tuberculosis were very tenacious of life in their dry state. That his own experiments showed this, and that he called the disinfecting of the sputa the keynote of the situation.

Dr. Bryce, of Ontario, said that there were conditions which made health resorts favorable for some and bad for others of delicate constitutions, and that this fact should be regarded by physicians. He recommended sanitary precautions at boarding-houses and health resorts.

Dr. Rohé, of Maryland, said that if the proper precautions were not taken at health resorts the doctors need not recommend them to their patients.

Dr. Johnson, of Chicago, said that the bacilli were always present, and that there were certain places at which they did not act as in other regions. He advised the sending of patients of tuberculosis to cold and open regions, where the bacilli cannot live. Crowded cities were the worst places for consumptives, and that they should always be made to leave cities.

Dr. Beverley thought that the great mistake of patients was not to take up a permanent residence at some health resort.

Dr. Raines thought there was great danger from spitting on the sidewalk. This pernicious habit was a great aid to the spread of this dread disease.

Dr. Vandenbergh, of Buffalo, said offices and banks ought to be looked after and some system of ventilation and cleansing adopted.

Dr. Gihon introduced the following resolution, which was adopted:

Resolved, That a standing committee of five members be appointed by the president to formulate practical prophylactic

Dr. Hibbard, of Indiana, asked if swine red disease is the same as our hog cholera.

Professor Gomez replied that he thought it was.

THE TURKISH BATH

Was the subject of the next paper. Dr. Chas. H. Shepard, of Brooklyn, had prepared an admirable paper on the sanitary advantages of the Turkish bath. In the absence of Dr. Shepard the paper was read by Dr. Bailey, of Kentucky.

The paper related how the Romans used their hot baths as regularly as they attended to their religious duties. An English physician first brought the bath to the attention of his people through an incident brought to his attention while in Turkey. The special case which brought the matter up was the saving of the life of a man who had a sunstroke, by the use of the Turkish bath. Twenty-seven years ago it was introduced into the United States at Brooklyn.

It is computed that in England there are 125,000 deaths from causes which may be easily prevented. Heat being one of the best disinfectants, the hot air of the Turkish bath is a positive disinfectant. Steam destroys bacilli. The tolerance of the body for heat is shown by those who constantly use the Turkish bath.

An inability to perspire is apt to bring about disease, consequently perspiration brought about by a Turkish bath is extremely desirable. The Turks move their armies with less loss than any other. The English army counts on a loss of ten per cent from sickness. The bath brings the body in excellent condition to withstand disease or sickness. The Turkish bath is regarded as cleansing the inner, as well as the outer body. The writer gave an array of important facts in which the sanitary effects of the Turkish baths were shown.

SOME NOTES ON CHEMICAL DISINFECTION.

Dr. F. P. Venable, of the University of North Carolina, yet a comparatively young man, by his paper on "Chemical disinfection" showed that he had made many valuable and important examinations, and that he was a careful student of

this most important question. He thought that it would be well for state boards of health to publish lists of disinfectants which could be recommended. The paper caused more discussion than any thus far read.

Dr. Ashmun, of Ohio, said that this paper proved the necessity of the study of the question of disinfection. It also showed the intimate connection between bacteriology and chemistry.

Dr. Venable agreed that it would be a most excellent idea to have the two sciences brought together, i. e., bacteriology and chemistry.

Dr. Hibbard remarked that in his own town the health officer is using a vigorous system of disinfection against diphtheria.

Dr. Venable: "Wherever the corrosive sublimate can be avoided I think it would be well to do so."

Dr. Flick: "I have frequently used corrosive sublimate on myself as a disinfectant, and I have never experienced any trouble."

Dr. Ames: "I have used corrosive sublimate in disinfecting clothing of men on board of a vessel after an epidemic of small-pox without any bad effects."

Dr. Raymond, of Brooklyn: "The association has already published its report and we can find the information in an available shape."

Dr. Rohé: "I have been in charge of a hospital in Baltimore where we use for all the bed clothing bichloride of mercury. Every week the rooms are scrubbed with this solution. No one has ever yet suffered from this process."

Dr. Clark, of Buffalo: "When small-pox was an epidemic we used bichloride of mercury very freely without any evil results."

Dr. Durgin, of Boston: "We are using the solution freely in our hospitals. We have been doing this for about five years, and I have never yet heard of any evil results. As to the chloride of lime, we have used that freely. For small-pox we have used fumigation by sulphur."

Dr. Perkins, of New York: "I sympathize with Dr. Venable in his paper, and agree that we have much to fear from the lavish use of these special disinfectants."

Dr. Chapin, of Massachusetts: "If there is any danger from mercurial disinfectants, it is, I think, from continued living in a room filled with them."

Dr. Wilson, of Connecticut: "I acknowledge a lingering suspicion that mecurial disinfectants could be used to excess. I would, I think, use it with care."

Dr. Lewis, of Kansas City: "Our board of health has refused us the right to use bichloride of mercury for general disinfection."

Dr. Gihon: "I would move that a new edition of the report of the committee on disinfection be published."

Dr. Robinson, of Maine: "The whole ground has already been covered. The report of the committee has been accepted by the country and is now in general use."

Dr. Bailey did not think that there was sufficient additional information to warrant any expenditure at this time.

Dr. Lindsley, of New Haven, thought it advisable to have boards of health instructed in the use of disinfectants.

Dr. Daniells, of Wisconsin, asked that some instructions regarding the amount of moisture be incorporated in the resolution of Dr. Robinson. Carried.

The association adjourned at 6.10, to meet at the Grand Opera house for the evening session.

Evening Session.

It has been a custom to devote the first evening of the meeting to the reception of the association by the citizens; and in this, Charleston came to the front and entertained our delegation most royally.

The meeting was called to order promptly at 8 o'clock by Dr. H. B. Horlbeck, chairman of the local committee of arrangements, who introduced the Rev. Dr. C. S. Vedder, who opened the session with a prayer.

DR. J. S. BUIST.

After music by the orchestra Dr. Horlbeck introduced Dr. J. Somers Buist, Dr. Buist in welcoming the association said that the city of Charleston was alive to the honor which had been done her in being selected as the place of the meeting of so distinguished a body. Here, he said, was a body of men who were not only physicians but scientists, and who, without hope of reward, were working to place truth before the world. They were striving to make system and order displace ignorance and superstition, and to place before the public the needs of health. He sketched briefly the history of sanitation and how the great work had been so much aided in America by this association. In conclusion, Dr. Buist paid a high tribute to Dr. Koch, of Germany, and spoke of the great work he was doing for science in completing his discovery of the consumption cure.

PRESIDENT BAKER.

Dr. Buist was followed by Dr. Henry B. Baker, of Lansing, Mich., the president of the association, who delivered his annual address. The object of the association, he said, was implied in the name. It was devoted to the advancement of sanitary science and the promotion of public hygiene. He spoke of the difference in the methods of the various States in this work, owing to the laws which existed in different parts of the country. Not only, he said, was the whole of this country interested in the work of this association, but so were also the provinces of Canada and the Republic of Mexico. The latter country had here an official representative.

A mere abstract of Dr. Baker's paper fails to do it justice. It is to be published and should have a large circulation.

MR. J. P. K. BRYAN,

The next speaker, said that he rejoiced to welcome the distinguished visitors to a city that was known as the home of Agassiz, Simms, Thomas, Holbrook, Bachman, and Geddings, and to add his God-speed to the noble work of the

association. If our ideas of sanitation fell short of the highest mark, yet two object lessons in the study of public health may be found here. One has reference to our tropical relations and influences. By the wisdom and courage of the sanitary system, we have for nearly a generation been free from a scourge that has ravaged a sister city quite recently.

Another object lesson is presented by the most complete system of quarantine at the mouth of our harbor — a monument to the vigilance that rules here.

The theme discussed involves wide-spread interests and holds in its grasp the sunshine and happiness of our homes; among its aims are pure air and pure water. It concerns the intelligent dominion of Nature, whose secrets it elicits by the wand, as it were, of a modern enchanter. It has lengthened life, mitigated pain, fertilized the soil, spanned rivers, lighted up darkness, annihilated distance, facilitated correspondence, sounded the depths of the seas and the recesses of the earth, explored mountains, turned the course of rivers, subjected storm and whirlwind; but, better than all these things, it has stayed the black plague of despair and imparted to the poor leper and consumptive the hope of a new miracle, "Be thou clean and go in peace." Its activity is ceaseless; its goal to-day is its starting point to-morrow. The transfer to man of the mastery of creation tends to bind his soul to his Heavenly Father.

What a noble work! Consecrated to the good of his fellow-man and making all men kin in its mission of mercy. The majesty of this great republic bends in homage before it, but the still greater concourse of humanity waits to learn from its further ministrations. We have to-day a grander Olympia than the ancient Greeks, and our lists are open to all genius, whether in art, oratory, or song. The minds of all men turn naturally to an assemblage called to consult for the good advancement and glory of man. Mighty the victor and happy he who wins in such a contest. There are unknown heights and depths awaiting the lover of light and of men in this new world.

The last speaker on the programme was the eloquent pastor of the Huguenot church and the gracious presiding officer of the New England society, Rev. C. S. Vedder, D. D.

He said to the gentlemen of the Public Health Association: "The officials who have you in custody have determined that the capital sentence passed upon you should not be executed without 'benefit of clergy.' You had, perhaps, not expected the grace, nor been conscious of your need of it, but men are not always the best judges of the gravity of their own offenses, nor of the consideration which deals with them leniently.' My friend, Dr. Buist, acknowledged expert, has diagnosed your case, and pronounced unqualifiedly as to your sanity — nay, he avers that you are not only sane, but even sanitary in organization. The learned solicitor, Mr. Bryan, with characteristic cogency, has presented an argument which seals conviction. You have been found here, if not with arms in your hands, at least with hands on your arms, and if we have not already seized these evidences of the spirit with which you have come, we will do so soon. The community of Charleston, sitting as a Court of Winter — if not of last — resort has arraigned you in this building, so full of tragic memories, and you can expect no mercy. Charleston is remorseless in cases like this. There is no appellate court which can set aside or stay its judgment. There is only one high tribunal — St. Michael's steeple — from which a peal is ever heard in this jurisdiction, and if this be heard now it will only be to drown your cries at the hardships to which you will be subjected, or to add to those hardships by triple bob majors of exaltation from a repertoire which the recent gala week proved to include some strains of an effective character for circumstances like the present."

The speaker then went on to formulate the charge against the health association, of seeking to find and eradicate the seeds of human malady, and thus interfering with the livelihood of their many and good and well-beloved physicians, taking the bread out of their mouths by forbidding them to put bread pills in the mouths of others. And though their doctors gave

us welcome and were glad of our advice and aid in thus playing at cross purposes with their bread and butter, yet the community would not stand silently by and see its endeared medical men thus ruthlessly immolated upon the altar of self-sacrifice; and, therefore, the community had adjudged that the members of this Public Health Association should be visited and persecuted by all forms of public and social attention and courtesy, be immured in a building where they must wrestle with bacteria, bacilli, mephitic vapors, miasmatic conditions, and like savory matters, whilst the community looked on, uninterfering and unpitying. From time to time, to aggravate their imprisonment by contrast, they were to be taken out and around the city, to bemoan the fate that compelled them to live elsewhere, save, of course, in the favored localities, so much like Charleston, where they did reside; taken into their homes, so much sweeter than any others, except, of course, their own; be made to get, if not "half seas over," at least "over the bay," by being taken down to the bar; be invited to ride in railway coaches, where no dust could penetrate, and to explore the splendid system of drainage, without any drain upon their susceptible olfactories, etc., etc.; and when they had reached the limit of human endurance and were ready to go, to see their persecutors so unaffected by compunctions as to be willing to endure the whole programme, and hearing them giving to the health association the hearty send off: "Come again, as soon, as often, and in as great force as possible." The jury of the city has been polled, and it cries: "So say we all."

Morning Session, — Wednesday, Dec. 17.

Dr. Ashmun, of Cleveland, Ohio, submitted a report on behalf of the committee appointed to study and submit a paper on the cause of prevention of diphtheria. The committee had made a careful investigation of the question, and had made careful inquiry into the origin of this terrible disease. Of the answers received by the committee, 93 per cent indicate that diphtheria is dependent upon some specific cause.

The paper states that the opinion is that light-eyed and light-haired children are more liable to diphtheria than those of dark complexion and eyes. Cold, wet weather is the most calculated to spread the disease. In answer to the question whether domestic animals and fowls were regarded as subject to diphtheria and liable to give the contagion to children, 60 per cent of the answers indicate that dogs, cats, and fowls are subject to diphtheria, and their furs and feathers likely to carry the virus and give the terrible disease to children who play with them. Such cases have been actually observed.

The free use of antiseptics is advised. Stations for the disinfection of diphtheria are also advised.

The paper provoked considerable discussion, and a variety of opinions was expressed.

Dr. Wyman said that he had found that children of parents of weak lungs are very much more liable to diphtheria than others. He regarded the germ as being vegetable. He had found sulphur the best disinfectant. He regarded sugar-cane as a possible origin for the germ. He did not regard the disease as contagious.

Dr. Rohé suggested that the other members of the committee present be asked to say something about the report.

Dr. Bryce, of Toronto, one of the most careful and deliberate talkers on the floor, said that it was very difficult and practically impossible to tell from the examination of the throat whether a patient had diphtheria. We are to look upon every case as diphtheria until the contrary is proven. Four weeks he regarded as a proper time for isolation.

Dr. Kemp, of the Hoagland Laboratory, of Brooklyn, said that it was a difficult matter to find the bacilli of diphtheria.

Dr. Cantwell, of Iowa, related an experience in which one child was known to give the disease to forty children in a hospital.

Dr. Hibbard, of Indiana, asked: "How long do the bacilli of diphtheria live?" He related a case where a mother with two children visited a neighbor's house after the diphtheria had been thought cured in the patient for a month. Soon after both children died.

Dr. Kemp: "I do not think any examinations have been made on how long the bacilli live in rags and dirt. They will live in media for three months. How long they may live in a house is not known, I think."

Dr. Bahnson, of North Carolina, related a case which he thought showed that the bacilli of diphtheria lived for three years in a room.

Dr. Carter, of Indiana, said that the bacilli of diphtheria might be found in the milk of cows.

Dr. Daniells, of the University of Wisconsin, doubted if the disease was ever spread by water, and would like to know whether an explanation of this could be made.

Dr. Rohé moved that the resolutions of the committee looking to the establishment of stations and distribution of information to every state board of health be adopted.

The resolutions of the committee on diphtheria were adopted.

Dr. Rauch, of Chicago, introduced a resolution looking toward adding to the regular quarantine diseases, diphtheria, typhoid fever, measles, and chicken-pox. This, he thought, was necessary in addition to the present regulations regarding small-pox, yellow fever, and cholera. This regulation he regarded as necessary for all emigrant steamers.

Dr. Gihon moved that the committee on the pollution of water be continued. Carried.

The first regular paper submitted during the morning session was: "What constitutes a filth disease?" which was prepared and read by Dr. Samuel W. Abbott, secretary of the Massachusetts state board of health. Rags were occasionally the medium for the transmission of small-pox. The dust of some work houses may be the medium of disease. Phthisis is often communicated in this way. It is claimed that filth is often the origin of diphtheria, but the connection of filth to diphtheria is not quite so clear as it is to other diseases. He traced the history of diphtheria in a small town for eighteen months, and how its germs kept in an untenanted house for six months. Filth should be removed with intelli-

gence. It is a condition and not a cause of disease. The paper was well received.

One of the most technical and valuable papers read during the session was, "Some original observations on the value of microscopical, spectroscopical, and chemical examinations of black vomit as an aid to health officers in distinguishing yellow fever from malarial fever," by George T. Kemp, Ph. D., director of physiology and experimental therapeutics, Hoagland Laboratory, Brooklyn, N. Y.

Dr. Kemp has made quite a number of examinations of the vomit of yellow fever patients as well as malarial subjects and presented in a concise manner the results of his investigations. He presented in tubes several samples of yellow fever bile and made some very valuable suggestions on yellow and malarial fevers.

At about noon the association took a recess to accept the invitation of the "Emerson Car Ventilating Company" to witness the practical workings of a car, which had been fitted up after their patent, in a run of ten or fifteen miles up the Northwestern Railway to the delightful grounds of the Otranto club, near which is located the historic Goose Creek church, quaint in architectural design, having been built in 1706, and the famous avenue of large-sized water-oaks draped in flowing robes of perennial moss.

The following description of the Emerson system of car ventilation was given the association by Dr. J. Somers Buist, one of the projectors of the enterprise:

"Exclusion of dirt, dust, smoke, cinders, in the system alluded to (Emerson) is accomplished by keeping the car closed entirely, neither windows nor doors being opened, and all ventilators in the roof of the car or upon its sides being closed or removed. It will thus be seen that there is no possibility of the introduction of these disturbing elements from without, and should they enter at any time would be as rapidly removed as possible before they could find a lodging by the system at work to exhaust the foul air, to be now described.

"The introduction of air into the car thus practically sealed,

is accomplished by means of an apparatus attached under the car near one of the trucks, the motive power being derived from friction which comes into operation at the first turn of the wheel, and continues to work, either fast or slow, until the cessation of the movement of the train. It is understood that while the train is stationary both windows and doors will be opened to admit air if needed. The friction power being brought into operation moves a series of fans, which collecting the air, filled as it is with dust and impurities from beneath the moving train, rapidly passes it forward into a box attached from about two or three feet from the wheel, where it is divested, by passing through water and chemicals, of all impurities, and transmitted in a steady, uninterrupted flow into the interior of the car by a series of tubes of different sizes and dimensions, placed at proper intervals in different points of the car, either at the sides, in the ceiling, or in the floor, as taste and utility may direct and practice establish. These orifices of entrance are so arranged as in no way to create draft or affect the person of the individual. A series of fans attached to the same motive power and washed in the same apparatus and moving in opposite directions, constitutes the exhausting system, accomplished through orifices of exit placed in the upper part of the car; and as the balance between the entrance of air and its exit is equal, the influences of draughts are dispelled and an even temperature preserved. Pure air coming in at all times and in equal volumes, and air breathed being as rapidly removed, renders the ventilation perfect. On the same principle and with the addition of a coil of steampipe, heated air is introduced, and in cold weather the temperature of the air can be regulated to any degree found necessary. Accurate tests made of this invention have thus far shown:

"1. Complete exemption of dust and smoke from the interior of the cars.

"2. Pure, uncontaminated air entering in sufficient quantities to fill every requirement, and even reducing the temperature in the interior of the car many degrees, as shown by the mometrical test.

"3. The immediate removal of foul air as rapidly as it is generated, the solving of the great problem that has hitherto been the stumbling block in the way of the perfection of the system.

"The inventor claims the ability to reduce the temperature in hot weather to one that is pleasant and comfortable."

Evening Session.

The executive committee met at 7 P. M., and at 8 o'clock the evening session of the association was held, when the following papers were read:

"Underground Waters for Public Purposes," by Peter H. Bryce, M. D., secretary provincial board of health, Toronto, Ontario.

"Sulphuring or Bleaching Dried Fruits, a Mistake if not a Crime," by Joel W. Smith, M. D., of Charles City, Iowa.

"Sanitary Improvement of Stagnant Lakes near the Seashore," by Joseph H. Raymond, M. D., of Brooklyn, N. Y.

"The treatment of Sewage by Precipitation and Saturation," by Joseph H. Raymond, M. D., of Brooklyn, N. Y.

Dr. Raymond showed with his serviceable stereopticon the construction of tanks for the precipitation of sewage; the force of waves, as shown by the wrecks of walls and buildings, the construction of conduits and other matters connected with the explanation of the papers he had prepared. Dr. Raymond contributed two of the most excellent and interesting papers before the association.

"The relation of mechanical arts to preventative medicine, particularly illustrated by the artesian wells and tidal drains of Charleston," by A. Nelson Bell, M. D., editor of The Sanitarian, Brooklyn, N. Y.

It showed a careful study of the question, and especially of the artesian well and tidal drains of this city. Dr. Bell gave in his paper a complete and minute history of the drains and wells in Charleston. He quoted a number of authorities upon the sanitary systems of the city.

THE TIDAL DRAIN SYSTEM OF CHARLESTON.

Mr. L. J. Barbot presented a most interesting and valuable paper on the tidal drain system of Charleston. Mr. Barbot showed that he had the subject, which he had made a study for years, at his fingers' ends, and his explanations were so complete and graphic as to be perfectly understood by all.

Upon motion, Dr. Bryce's paper, which was deferred from the afternoon session, was made the special order for the first place in the morning.

The association adjourned at 10.15 P. M.

MORNING SESSION, — THURSDAY, Dec. 18, 1890.

After a report by the chairman of the committee of arrangements the following resolutions were recommended by the executive committee and passed.

By Dr. Wood: That a committee of this association be appointed to confer with a similar committee of the American Medical association to observe in some appropriate way the centennial of the discovery of vaccination.

By Dr. Rohé: That the report of the committee on the cause and prevention of diphtheria be printed in pamphlet form as soon as practicable and that copies be furnished to each state board of health.

Dr. Gihon: That a standing committee of five members be appointed by the president to formulate practical prophylactic measures for the prevention of the spread of tuberculosis, especially looking to the protection of the healthy members of the community from tuberculosis infection.

The favorable report of the auditing committee upon the treasurer's report was next adopted.

HYGIENE OF COOKING.

Dr. Abbott, of Boston, said that one of the most important works ever done by the association was the publication of the prize essays written for the "Lomb Prizes." The essays are now regarded as high authority. One of these essays was

by Mrs. Abel and gave valuable and new information about the kitchen.

Dr. Walcott, of the committee on health commissioner, was not prepared to submit a report. He asked that a committee be appointed to see what could be done with the present Congress towards securing the legislation desired.

The association adopted a resolution appointing a committee on legislation.

Dr. Plunket, of Tennessee, thought that it would be advisable to appoint one representative from each State and Territory on the committee on legislation, and that better results would in that way be accomplished. Carried.

IMPORTED DISEASES.

Dr. Durgin, of the committee on sanitation of foreign ships, submitted an excellent report. The fact that during the past ten years over five millions of immigrants have come to America ought to give the question considerable interest. Statistics showed that of the population of 1880 there was one pauper to every 985 native-born Americans, and one pauper to every 285 foreign-born inhabitants.

The ventilation of emigrant vessels, he said, was very defective. The unclean habits of most emigrants, the poor accommodations and miserable ventilation of our steamers are very likely to produce disease. There is a great lack of necessary information on hygiene among the officers of vessels. The law giving the master entire control of the vessel is not desirable. The health officer should have more authority. Better protection to the country requires a revision of the present laws. There should be requirements that all persons leaving or coming into the country should be subject to a thorough medical examination, and no one suffering with an incurable or contagious disease should be permitted to come into the country.

Vaccination should be required.

Proper ventilation of emigrant vessels should be required.

Every vessel should have one credited health officer to every six hundred passengers or less.

The medical inspector should be required to inspect the vessel daily and report to the master.

The master should be required to answer all demands of the vessel's health officer.

VACCINATION.

Dr. Gihon moved that the paper on the vaccinal protection of passengers from Europe, by Frederick Montizambert, M. D., quarantine officer of the Dominion of Canada, Quebec, be next read, as it had direct bearing upon the question under discussion. Carried.

The paper of Dr. Montizambert was a clear and practical demand for the enforcement of laws requiring vaccination of all persons coming into the country. The nation demanded such protection and he hoped that the association would do its best to secure the necessary legislation. Small-pox, wherever found in America, had its origin on foreign vessels. It is never native-born. There was absolute need for imperative laws upon vaccination and he was very sorry that America did not have any laws requiring general vaccination for all immigrants.

The report of the committee and the paper of Dr. Montizambert will be a great acquisition to the matter to be used in urging strict enforcement of quarantine laws and the passage of stricter laws.

The two papers will be published and copies sent to the members of the American and Mexican Congresses and the Canadian Parliament. Dr. Gihon thought that some good results could be expected from such a publication and distribution.

The last paper read before the departure for the quarantine station at Fort Johnson was, "Maritime Sanitation at Ports of Arrival," by H. B. Horlbeck, M. D., quarantine officer of the port of Charleston. The paper was one of the most admirable presented to the convention. It was clear, concise, and well framed, and gave to the members of the association a full insight into the workings of the station at Fort Johnson.

He gave an elaborate and detailed account of the quarantine laws of Charleston, and showed how rigorously the health of Charleston was guarded in colonial days against the importation of disease. Yellow fever, its origin and how it became prevalent in Charleston, were thoroughly discussed by Dr. Horlbeck. He gave a graphic account of the plagues of Charleston and the Mississippi valley. The plague of 1864 was introduced by intercourse with the West Indies at that time.

Dr. Horlbeck gave a complete and detailed account of the workings at the quarantine station over which he has direction.

At the evening session the following papers were read:

"The Hygienic Value of Rational Irregularities in Habits of Living," by James F. Hibbard, M. D., of Richmond, Ind.

"Land Monopoly to Population Health," by George Homan, M. D., secretary state board of health of Missouri, St. Louis, Mo.

"Climate in Phthisis," by W. H. Geddings, M. D., of Aiken, S. C.

"House Drainage," by Albert L. Webster, Sanitary Engineer, New York.

"Trap Siphonage," by Prof. James E. Denton, Stevens Institute of Technology, Hoboken, N. J.

The following resolution was adopted:

Resolved, That a committee of five be appointed, of which Dr. John H. Rauch, of Chicago, shall be chairman, to inquire into the expediency of having a sanitary exposition at the International Fair in 1893.

Report from the state board of health, South Carolina, by J. R. Bratton, M. D., president.

"Leprosy and its Management in Minnesota," by Charles N. Hewitt, M. D., secretary of the state board of health, Red Wing, Minn.

The following resolution was adopted:

WHEREAS, Owing to the fact that cholera has prevailed during the past summer in Europe, Asia, and Africa, and

WHEREAS, There is a possibility that it may be introduced into this continent during the coming year; be it, therefore,

Resolved, That all maritime quarantine authorities be urged to continue special care to prevent its introduction, and that all other health authorities continue to do everything in their power to improve the sanitary condition of the country.

MORNING SESSION, — FRIDAY, Dec. 19, 1890.

The programme was made up largely in matters pertaining to unfinished business reports of committees and the election of officers.

The reports of the standing committees were received and ordered published, and a number of papers were read by title and ordered published. The reports and discussions on the Coney Island system of drainage were ordered published in the proceedings.

In response to an inquiry from Mr. Griffith, of Chicago, Dr. Horlbeck gave a sketch of the method of drainage used in Charleston, which was heard with great attention.

The report of the advisory council was presented and ordered published, and the election of officers was then held, with the following result:

President, Dr. Frederick Montizambert, Quebec, Canada.

First vice-president, Dr. T. F. Wood, North Carolina.

Second vice-president, Dr. H. B. Horlbeck, Charleston.

Secretary, Dr. I. A. Watson, Concord, New Hampshire.

Treasurer, Dr. J. B. Lindsley, Nashville, Tennessee.

Executive committee — Dr. George Homan, St. Louis; Dr. A. W. Cantwell, Iowa; Prof. W. W. Daniells, Wisconsin; Dr. L. F. Salomon, Louisiana; Dr. Wm. Bailey, Kentucky.

VISIT TO AIKEN.

The invitation of the citizens and chamber of commerce of the city of Aiken, to the association to visit that renowned

sanitarium, was accepted by over sixty members who were provided with a special train and a bountiful lunch.

On the arrival of the train at Aiken we were received by a large committee of the city officials and others, who escorted us to the Highland Park Hotel and most royally entertained us with a reception and banquet.

It is a delightful city and geographically is finely situated for a resort for invalids, being located upon a plateau over 700 feet above tide water, it is free from dampness and malarial influences so common within so short a distance from the coast.

Those who were so fortunate as to be able to enjoy their hospitality, will long remember the good people of Aiken and their kindness to the members of the American Public Health Association.

HISTORICAL AND OTHER FACTS REGARDING VACCINATION.

BY IRVING A. WATSON, M. D.

In this age we know very little of the frightful and fearful epidemics of small-pox that have desolated whole countries and left behind only death, poverty, and sorrow in their withering trail, except as we read the terrible revelations of history. The epidemics from this disease for more than a generation, though in some instances very severe, like that of Boston in 1872, and that in Montreal in 1885, in which some three thousand human beings were needlessly sacrificed, are no more to be compared to the epidemics of former times, than the gentle breezes of a summer's evening are to the devastating cyclone.

In earlier times this disease was the cause of *one tenth* of all the deaths in Europe. It is estimated that in all Europe 450,000 died annually from small-pox; 30,000 died each year in France; 27,000 died in Prussia in a single year out of a population of seven millions.

The Europeans carried the disease, by commerce and explorations, from the equator to the frigid zones. The Danes imported it into Greenland; the Spaniards planted it in unhappy Peru, and its ravages were more terrible than the atrocities of their arms; in the single province of Quito 100,000 persons were swept away on its appearance in that country. In the colonial days of our own country it destroyed almost entire communities; as late as 1721 one half of the population of Boston were affected with it at one time.

Its contagiousness, its great fatality, and the horrible disfigurements that were generally stamped upon the faces of those that recovered, made it a disease "more to be dreaded than the plague."

Inoculation was frequently practiced to limit in a degree its ravages, or in other words, the poison of the disease from a fresh case was introduced into the arm of the person. This produced the true small-pox, but usually in a milder type than followed when taken in the natural way. This method, however, was attended with great danger, as the inoculated person not unfrequently died from the disease thus induced; the liabilities to contagion from such a case existed as in an ordinary case; the person inoculated had to be isolated in a "pest house" or hospital. Still with its objections it was, in the days immediately preceding the discovery of vaccination, very generally resorted to, because it was so certain that the disease could not be avoided, and many assumed the risk of inoculation immediately upon the appearance of a case in their locality.

This method, however, was under the regulation of rigid laws, and seemingly left as a monument in history, such an enactment existed in the General Laws* of New Hampshire, until the year 1887, and possibly has not been repealed in other States where it was once legalized.

In 1798 Edward Jenner announced to the world the discovery of vaccination. In 1801, in answer to numerous inquiries, he said,† "My inquiry into the nature of cow-pox commenced upwards of twenty-five years ago. My attention to this singular disease was first excited by observing that, among those whom in the country I was frequently called upon to inoculate, many resisted every effort to give them small-pox. These patients I found had undergone a disease they called the cow-pox, contracted by milking cows affected with a peculiar eruption on their teats. On inquiry, it appeared that it had been known among the dairies time

* Chapter 112, section 5.
† Medical and Physical Journal, vol. v., p. 505, London, 1801.

immemorial, and that a vague opinion prevailed that it was a preventive of the small-pox."

Other writers corroborate the fact that in the agricultural districts of Europe the cow-pox had long been known to dairymen as a protection against small-pox. Pearson,* in 1800, in writing upon vaccination, said: "The safety of the practice is confirmed by the inoculation [vaccination] so long practiced among the peasants in several parts of England, in the rudest manner, with pointed knives, awls, etc., time immemorial."

Barry, a practitioner and writer contemporaneous with the authors just mentioned, says much upon the antiquity of cow-pox and its being known among the peasants as a protection against variola. He says: "The Irish name of the disease (Shinach) belongs to the old written language of the country, and has no relation to the modern colloquial dialect; this I consider a strong proof of the antiquity of the distemper. It is evident from the facts I have stated, and from the remainder which I have myself collected, or received from friends, that the belief of the anti-variolous power of the disease is as ancient as that of the existence of the disease itself."

It would seem that Jenner's great discovery was simply the recognition of facts which were familiar to many of the common people; but it was reserved for him to demonstrate to medical and scientific minds the value of these facts which in a simple way were best known to milkmaids. His own words best describe his progress in proving his theories:† "During the investigation of the casual [natural] cow-pox, I was struck with the idea that it might be practicable to propagate the disease by inoculation, after the manner of the small-pox, first from the cow, and finally from one human being to another. I anxiously waited some time for an opportunity of putting this theory to the test. At length the period

* Pearson did everything in his power to rob Jenner of the honor of the discovery of vaccination, by asserting that he had done more than Jenner to diffuse the knowledge and place it upon a basis to be thoroughly understood by all. His attempt, however, was an ignominious failure.

† Loc. cit., p. 507.

arrived. The first experiment was made upon a lad of the name of Phipps, in whose arm a little vaccine virus was inserted, taken from the hand of a young woman who had been accidentally infected by a cow. Notwithstanding the resemblance which the pustule, thus excited on the boy's arm, bore to variolous inoculation, yet as the indisposition attending it was barely perceptible, I could scarcely persuade myself the patient was secure from the small-pox. However, on his being inoculated some months afterwards, it proved that he was secure. This case inspired me with confidence; and as soon as I could again furnish myself with virus from the cow, I made an arrangement for a series of inoculations. A number of children were inoculated in succession, one from the other; and after several months had elapsed, they were exposed to the infection of the small-pox — some by inoculation, others by variolous effluvia, and some in both ways — but they all resisted it. The result of these trials gradually led me into a wider field of experiment, which I went over not only with great attention, but with painful solicitude. This became universally known through a treatise published in June, 1798. The result of my further experience was also brought forward in subsequent publications in the two succeeding years, 1799 and 1800. The distrust and scepticism which naturally arose in the minds of medical men, on my first announcing so unexpected a discovery, has now [1801] nearly disappeared. Many hundreds of them, from actual experience, have given their attestation that the inoculated cow-pox proves a perfect security against the small-pox; and I shall probably be within compass, if I say that thousands are ready to follow their example, for the scope that this inoculation has now taken is immense. An hundred thousand persons, upon the smallest computation, have been inoculated [vaccinated] in these realms. The number who have partaken of its benefits throughout Europe, and other parts of the globe, are incalculable; and it now becomes too manifest to admit of controversy, that the annihilation of the small-pox, the most dreadful scourge of the human species, must be the final result of this practice."

The opinion expressed in the last part of the above quotation will not be taken with surprise by any medical man who has studied the subject of vaccination. It probably was not conceived in the mind of Jenner that quackery, superstition, ignorance, and dishonesty would combine to defeat the results which he predicted; neither will any one regard him as over enthusiastic in describing its prophylactic powers, when it is stated that within five years after giving his discovery to the world, six thousand persons, who had been previously effectually vaccinated, were inoculated with the poison of small-pox, and not one of the number contracted the disease.

Dr. Woodville, of London, within two years after the announcement of the discovery of vaccination, inoculated one thousand well vaccinated persons with the virus of small-pox and none received the infection.

The protection given by vaccination was so conclusively proven that, as a further test, physicians, and in some instances ministers, placed their children in houses infected with the worst type of small-pox, with impunity.

Vaccination was performed to quite an extent by clergymen. Indeed, the better educated among them used every honest endeavor to awaken their parishioners to the great value of the operation. Rev. G. C. Jenner vaccinated "three thousand persons without meeting with one unfavorable case, although he had inoculated [vaccinated] persons from the earliest infancy to eighty years of age." * * * "Upwards of two hundred of his patients have since been inoculated with active small-pox matter, and at least an equal number exposed to contagious effluvia, but in no instance was the small-pox produced."* The proofs of its efficacy were so strong that the operation was introduced from England with great rapidity into every civilized country.

Dr. Waterhouse, "Professor of Physic at Cambridge in New England" obtained some vaccine virus from a friend in Bath, England, and acknowledging the same under date of Aug. 4, 1800, said: "Accept my best thanks for the phial

* Testimony before the House of Commons, 1802.

of vaccine poison. Its activity I have experienced on my nearest connections. I have inoculated five of my own family, and roused the public attention even beyond what I had imagined. The symptoms and appearance in the inoculated part were exactly similar to those described and pictured by Dr. Jenner. I shall try the variolous matter on them in a week or two. I consider this as a very important thing to my country, where the dread of the small-pox is still great.

"I have ventured to give a new name to the vaccine disorder. I observe that people revolt at the term cow-pox. I have therefore changed it to *kine-pox*, from kine, the plural of cow. As I am the only one in America who has published anything on that new disorder, I am in hopes to establish that name instead of the former. If it should obtain, I can foresee that the *e* will be changed in time into *d*."

This, indeed, is a significant letter and shows from what source the name, which has been so commonly used in this country, was derived. Dr. Waterhouse wrote a small work upon vaccination, in acknowledgment of which he received the following from the president of the United States:

WASHINGTON, Dec. 25, 1800.

SIR, — I received last night, and have read with great satisfaction, your pamphlet on the subject of the kine-pox and pray you to accept my thanks for the communication of it. I had before attended to your publications on the subject in the newspapers, and took much interest in the results of the experiments you were making. Every friend of humanity must look with pleasure on this discovery, by which one evil more is withdrawn from the condition of man; and must contemplate the possibility, that future improvements may still more and more lessen the catalogue of evils. In this line of proceeding you deserve well of your country; and I pray you, sir, accept my portion of the tribute due to you, and assurances of the high consideration and respect with which I am, sir,

Your most obedient and humble servant,

THOMAS JEFFERSON.

To Dr. Waterhouse, Cambridge.

The literature of vaccination, published within three years after its discovery, shows that the subject had been ably considered in all its details, bovine and humanized virus, communication of disease, spurious vaccination, decomposed virus, etc., etc. The anti-vaccinationists presented the same line of pseudo-arguments, and employed the same senseless and demagogical allegations in support of their assumed position as now — perhaps in some respects even exceeding them.

They based one of their strongest points in opposition to vaccination upon the hope of instilling into the mind of the ignorant, the idea that it was a *beastial* disease, or humor, and that by introducing it into the system they received a disease which did not belong to the category of ills, placed by divine favor or disfavor, as the case might best suit the purpose of their argument, upon sinful mankind.

The beneficent discovery was, however, not allowed to be assailed unanswered. To the charge above mentioned Dr. Henry Jenner, a surgeon of London, forcibly said:* "If this very weak and futile objection were worthy of reply, we might observe, that the cow is of all others the most healthy and the most cleanly of our domestic animals, and might also remark, that no females are so healthy as our dairy maids, whose morning and evening hours are spent amongst the cows." * * * "How void of foundation then must be the objection to the insertion of an atom of matter taken from the teat of the cow, once in the life only, when every person is in the daily habit of introducing into his stomach various parts of the same animal. The human stomach revolts not at beef, butter, cheese, and cream; yet every one acquainted with the animal economy must know that these aliments are quickly mingled with the constitution."

In as logical a manner was every objection to vaccination met, but the extent of the absurdity to which the opposition was carried by ignorant and bigoted fanatics, may be illustrated by a single quotation from a paper on vaccination, written by

* An address to the public on the advantages of vaccine inoculation, with the objections to it refuted. London, 1800.

Dr. Richard Dunning in 1802. He said: "Some with a well feigned expectation of finding them, and therefore, with an ingenious cruelty peculiarly their own, have sought for, on the heads of children lately vaccinated, the approaching horns, and at the same time have, with equally affected seriousness, inquired if a something had not been noticed in their voices, imitative of the bellowing of a cow."

It should be noted that in the period under consideration, the value of the discovery had not been proven to the satisfaction of all, hence that it, like any new theory, would be assailed was to be expected; but such an attempt as that reported by Dr. De Carro, of Vienna, to bring the operation into disfavor, serves to show to what terrible extremes the effort was carried.

"A law suit of the most abominable sort is now going on at Berlin, between a banker of that town and Dr. Wolf. That physician was requested by the banker to vaccinate his children. He complied with the request; but instead of taking vaccine virus he took variolous [small-pox] matter of the most confluent kind. Those two children died during the inoculation. The parents, astonished to see such symptoms produced by the *vaccination*, made the strictest inquiry, and traced the evil to its origin. A regular charge was brought against that monster, but I do not yet know the result of it."*

The chief danger was then considered to be, and is no less so now, from using virus that was too old, or that taken at an improper stage in the development of the vesicle. The result of the use of such virus is not the introduction of disease into the system, but the creation of a local sore of more or less severity without giving the person any protection. So important was the operation regarded by the physicians in the earlier days of vaccination, that they deemed it necessary to see the patient in a few days afterward to determine whether the result was protective or not. There are numerous persons on whom the operation of vaccination, performed with a point or lancet perfectly clean and free from vaccine

* Medical and Physical Journal, vol. viii, London, 1802.

virus, would cause a sore not less severe than that which often results from true vaccination. Hence, a sore is not unfrequently produced which the subject regards as a vaccination vesicle, when infection from the vaccine matter has not taken place.

Such a person in after years having small-pox, the anti-vaccinationists flaunt the fact as an instance in which vaccination was not a protection. The assertion which has been made, that by vaccination "humors" are introduced into the system, is probably not true in one case, so stated, in ten thousand. It is true that not unfrequently an eruption, or perhaps pimples, appear for a time after vaccination; but who has not seen the same condition produced in some persons by articles of food like mince pie, strawberries, honey, lobsters, etc., or by the taking of certain medicines? The whole solution of the question is in the fact that some systemic disturbance follows, that manifests itself on the skin or elsewhere; some latent so called scrofulous condition may for a time be brought into activity, or a metastasis of a hitherto unrecognized affection may have taken place, relieving some internal organ by placing its burden for a time upon the skin. This is all there is to the so called cases of "disease introduced by vaccination" that it has been the writer's fortune to see. On the other hand, the health is not unfrequently improved by vaccination. Eruptions, classed as scrofulous, upon the face and body have been known to disappear as a result of vaccination, which failed to be removed by medical treatment or local application.

The following may be stated as incontrovertible propositions:

1. That all children should be vaccinated before they are one year old.

2. That vaccination with *fresh* bovine virus, or from the arm of a healthy person, *taken at the proper time and in a proper manner*, can communicate nothing but the vaccine disease.

3. That a person who has had the vaccine disease is pro-

tected from small-pox for a certain number of years afterward.

4. That owing to an unexplained idiosyncrasy the protection afforded by vaccination is, in some persons, exhausted in a few years; hence, revaccination should be occasionally resorted to, especially if small-pox is prevailing.

5. That no reliance can be placed upon the vaccine scar as to how long the protection of vaccination exists.

6. That in a well-vaccinated community small-pox can never become epidemic.

7. That it is the duty of every individual to avail himself of the protection which vaccination affords.

Dr. J. M. Toner puts this idea in the following forcible language: "Parents and guardians have no more right to withhold or neglect to provide vaccination for the children under their protection, than they have to jeopard the lives of these helpless infants by not furnishing them with food or clothing. It is criminal to neglect either, as death may be the consequence; but the failure to provide protection against small-pox seems to be more maliciously wicked than to neglect either food or clothing, as the former may not only cause the death of the child, but may be the means of spreading disease and death among many others; while the evil which arises from the latter, ceases with the death of the victim."

A thoroughly vaccinated person resists all exposure to the infection of small-pox — does not contract even varioloid. Many do not understand this, but regard vaccination as only mitigating the severity of small-pox by changing its form to varioloid. Were the latter true we should have epidemics of varioloid as extensive as the epidemics of small-pox in former times. There are, however, occasional individual exceptions to this rule, but they are exceedingly few.

"Dr. Marson, having the greatest experience perhaps of all writers upon this subject, says of the test of vaccination in preventing small-pox: 'For thirty years we have revaccinated all the nurses and servants who had not had small-pox,

on their coming to live at the small-pox hospital, and not one of them has contracted small-pox during their stay here.' "*

But it is unnecessary to multiply the illustrations. Those who desire to study the subject can find trusty records and statistics to prove the marvelous protective power of vaccination. In vaccination and revaccination all may be safely fortified against one of the deadliest foes to mankind.

* Public Health: Reports and Papers of the American Public Health Association, vol. ix, p. 284.

THE PRESENT POSITION OF THE MILK-SUPPLY PROBLEM FROM THE PUBLIC HEALTH STANDPOINT, AND SOME PRACTICAL METHODS FOR SECURING SAFE PUBLIC SUPPLIES.*

BY PETER H. BRYCE, M. A., M. D., SECRETARY PROVINCIAL BOARD OF HEALTH OF ONTARIO, TORONTO, ONT.

GENTLEMEN, — During the interval since our last meeting I have been requested to introduce for discussion a paper on "Public Milk-Supplies." In order to properly lay before the association a subject so broad in its practical bearings and so replete with important and interesting details, a paper greatly extending the limits of time allowed for any single subject would be necessary. I shall, therefore, deal briefly with the first part of my subject, in order that I may discuss at greater length those numerous details with which every executive officer of health ought to be familiar.

1. *The Use of Milk as a Food.* — Perhaps nothing will better indicate the importance of guarding this source of food-supply, than to recall the enormous consumption of what from earliest times has been more or less universally used as food by all nations. It is the natural food of all young mammals, whether human-mammal or beast-mammal. "Milk, from the earliest times," says Dr. Wynter Blythe, "even when its composition was most imperfectly known, has been considered the type of foods." Statistics may be given to illustrate the extent of the use of milk and milk-products.

In the Province of Ontario, 737 cheese factories were

* Read at the nineteenth annual meeting of the American Public Health Association.

reported in operation in 1888. Calculating from returns made by 557 factories, the following table is given:

No. of factories.	Milk used, lbs.	Cheese made, lbs.	Value.
737	686,369,013	65,299,751	$6,031,470

In 404 factories, with complete returns, the amount of milk used was 402,599,463 pounds from 150,618 cows. The average number of days in which the factories worked was 155, and the average amount of milk per cow was 2,673 pounds. The total number of patrons was 24,644, or about one eightieth part of the population of the province.

Assuming that two thirds of the population of Ontario is agricultural, we may say that but one tenth of the total production of milk in the province for 155 days, or less than half a year, was utilized for cheese-making. Now, if we multiplied the quantity of milk by ten, and added a half for the number of months remaining, we should have the enormous total of over 10,000,000,000 pounds of milk produced during a single year, or fifteen pounds *per capita per diem*.

Remembering that the great bulk of the cheese-products are exported, and that butter and milk are the chief foods used in Ontario, it is quite probable that this statistic is not greatly overestimated.

The report of the Ontario Bureau of Industries for 1890, states that there were in the province that year only 175,000 farmers, having 777,838 milch cows. We have, however, to add to these the many thousands of cows which are kept for purely milk-supply purposes by people in the cities, towns, and villages.

From statistics, I find that in 1890 the number of cows in the United States is given as 15,952,883, each yielding, on an average, 450 gallons per year, or a total of 6,750,000,000 gallons; and that only five per cent of this total is used as butter and cheese, the balance 95 per cent being used as milk in its natural state. If all were sold at 12 cents per gallon, it would amount to $810,000,000. In New York State there are 1,552,373 cows.

If, then, this single food-product, having a value so enormous and in itself a perfect food, is to be continued as a universal food, it is apparent that this association cannot engage itself with any single subject with such potentialities for good as this food of the nation, or such possibilities for evil, if we admit that it may possess, or become, the medium for disseminating ills, perchance as numerous as those from Pandora's box.

When we think that in the United States there is one milch cow to every four inhabitants, and that one hundred gallons *per capita* is the amount of milk produced annually, we have some idea, not only of the magnitude of interests involved and of the use of milk and milk-products, but also of the enormous task involved in maintaining these 15,000,000 milch cows in good health, and in protecting the milk, when produced, against pollution. There are in the United States 42,000 (graduated in ten years) physicians, whose duty I assume to be to maintain the people in good health or to heal those who are sick. What number of veterinary physicians is there, I ask, who are devoting their attention to the problem of maintaining these milk-producing animals in health, or in preventing evil results from attending the use of milk, unwholesome at the time of taking from the cow, or in its often strange and eventful history up to the time it reaches the consumer?

When we refer to the infectious diseases alone, which affect the bovine species, we see that they are of a number and character such as to urgently demand close attention and systematic supervision. Thus, they are subject to cancer, tuberculosis (in its several forms of scrofula, phthisis pulmonalis, tabes, tubercular meningitis, glandular tumors, etc.), actinomycosis, anthrax, symptomatic charbon (or black quarter), milk-sickness or "trembles," rinderpest or cattle plague. Texas cattle fever, vaccinia, scarlatina, parturient septicaemia, pyaemia, septicaemia, septic mammitis, glanders, diphtheria and croup, rabies, trichina, taenia, echinococcus, pleuropneumonia, eczema contagiosa (foot and mouth disease), etc.

In this extended list I have selected diseases, every one of

which has been probably known to this continent, and some of them, unfortunately, too well known. As a rule, it is not those *maladies fulminantes*, slaying whole herds in a few weeks, that cause us alarm in the matter of milk-supply, but rather those less acute diseases, which, owing partly to ignorance, partly to carelessness, and not infrequently to culpable cupidity, while not depriving a cow wholly of her milk-producing ability, are disseminated in milk-supplies to an extent proportionate to the numerous opportunities offered and to the vulnerability of the person taking the milk.

The past has legends enough of disease spreading to man, which, with greater care, to-day are not so commonly seen; but we are not wanting in illustrative cases. Thus, during the past summer anthrax appeared in an Ontario county in cattle feeding on bottom lands along a creek below a tannery where South American hides are used. Several animals had died suddenly, from what was supposed to be chemical poisoning due to the polluted water from the tannery. The matter being brought to my notice, I investigated, and suspected anthrax, which was verified in my laboratory. In the meantime another cow sickened. She was milked in the evening, and some one luckily suggested the advisability of not using the milk. It was given to some young pigs. Two died within four days thereafter; the majority recovering, as frequently takes place in pigs. Thus in England and Wales, out of 210 pigs attacked with anthrax in 1890, 117, or over 55 per cent, recovered.

In this outbreak just referred to, a man who, after being warned regarding the nature of the disease, skinned another cow which had died, intending to surreptitiously dispose of the skin, became inoculated, and lay for sometime in a dangerous state.

Of those diseases, however, which, owing to their less acute character, we have most difficulty both in detecting and eradicating, actinomycosis is taking a place prominent in the degree that its nature and prevalence are being recognized. On a single day four head of cattle infected with this disease

were received into the Toronto cattle market, and the disease has by statute this year been placed amongst those scheduled as unfit for human food. Some of the dangers of its spreading and of the difficulties in dealing with it, are admirably set forth in the annual report for 1890 of the health officer for Chicago.

But, as compared with other diseases, the one which must be recognized on every hand as being, *par excellence*, that to which sanitarians, medical health officers, and physicians must devote their special attention, is tuberculosis. That tuberculosis causes one seventh of all the deaths of the human race is stated by reliable statisticians; that it prevails in almost every land is well known; that it is disseminated everywhere on the American continent is equally well established; and that it has greatly increased in prevalence is unfortunately too true. That until recent years it prevailed but little amongst American cattle is probable; but that it has increased, as animals improved by in-and-in breeding have been imported for stock purposes, is well known; and that it has been rapidly developed by the growth of dairying for the supply of milk to the enormously increased populations of our American cities has now become a well authenticated fact. These facts are sufficient to cause us to pay some special attention to the more prominent points of interest associated with the disease in milch cows.

In 1890, of all the cattle slaughtered in Berlin, 4.5 per cent were tuberculous; while in Upper Silesia, 9.5 per cent of all slaughtered in a single abattoir were tuberculous. Bitter affirms that, while statistics are not extant, there are, he has reason to believe, at least 10 per cent of dairy cattle tuberculous in cities and their environs. No precise statistics have anywhere been tabulated regarding the prevalence of tuberculosis in dairy cattle in British cities, but that it is much too prevalent may be gathered from evidence such as that published by the local government board's report regarding tuberculous meat in Glasgow. The reason for the absence of such reports is that tuberculosis is not included in the list of contagious

diseases in the (Animals) Contagious Diseases Acts of England and Wales, and animals affected with it can only be got at by the by-laws regarding unwholesome meat and milk. In the report of the Veterinary Department of the English Board of Agriculture for 1890, the following occurs in a paragraph referring to tuberculosis being placed on the list of contagious diseases in animals: "Recently the subject has been brought to the notice of stock owners and dealers in a very pronounced way, in consequence of the very frequent seizure by sanitary authorities of carcasses of animals, which, after being sold in open market as healthy cattle in fine condition, had been found affected on post-mortem examination, and had been confiscated without any compensation to the purchaser, who had acted throughout in good faith, as also had the seller and all other persons concerned in the transaction.

"That the sufferer should appeal to the government for compensation was natural, since they asserted that, (1) The fact that many animals apparently healthy show after slaughter tuberculous disease, and, (2) That there is no ground for seizure and destruction of meat which was perfectly healthy to the eye of the meat inspectors, merely because some of the internal organs were affected with tubercles."

A royal commission has been the outcome of these representations, which is inquiring into the degree of infectiveness of the meat of tuberculous animals.

The same report gives the results of some experiments carried on during several past years to determine this important point. The following facts are granted, viz.:

(a) Lower animals may be infected with tubercle derived from the human subject.

(b) Bovine tuberculosis is communicable to other animals by inoculation, and by feeding with tuberculous material.

(c) A peculiar character of bovine tubercle, "grapy" form (perlsucht), does not appear in any animals as the result of experiments.

(d) The inference that man is susceptible to infection from the lower animals remains, and must always remain, based on analogy, direct experimental proof being unattainable.

The experiments undertaken were with the intention of determining whether meat of tuberculous origin, yet not containing any obvious tubercles or any tubercle bacilli detectable in microscopic examination, is capable of producing tubercle.

The experiments were carried on in three sets. In the first series, where seven rabbits and six guinea-pigs were fed upon muscle from undoubted cases of tuberculosis in cattle, post-mortem examinations, all within a few weeks (three or four months), showed that ten of these animals, or 77 per cent, were affected with tuberculosis; while five animals fed on milk from cases of undoubted tuberculosis, or on material other than milk from doubtful cases, were all, without exception, found to be in a normal and healthy condition.

In the second series, nine guinea-pigs were fed with tuberculous muscle mixed with oats and bran for five days. The feeding took place in the middle of December, 1890. On January 2, one animal was taken from each of the three cages and examined post-mortem, and not a trace of tubercle was found in any. From the 3d of January to the 10th, the remaining six were fed with pressed meat juice added to bran and oats; thereafter, on ordinary diet. On January 14, one died, and was found to have tubercular disease. On the 20th of January, another died with pronounced disease of intestines. On January 22, a third was found dead with extensive disease of lungs, liver, spleen. All of the remaining animals of the series showed pronounced tubercular disease, especially of organs of the alimentary canal. The two central animals, fed on bran and oats only, were killed early in February, and were found perfectly healthy.

Here the percentage of well marked cases of tuberculosis in animals fed on muscle or juice was 75 per cent.

A third series of experiments, carried on in Edinburgh, in the laboratory of Professor McFadyean, were negative in their results, and comparable with similar experiments by Nocard and Bollinger. Professor Brown remarks, regarding these three sets of experiments: "On the other hand, the first and

second series of experiments leave us no room for doubt that meat taken from tuberculous cattle, the tubercle being trimmed off without any special precautions, exactly as is done by the butcher, is capable of causing the disease in animals which partake of it in a raw state. The further question of the degree of cooking which is necessary to destroy the infective character of the meat, has yet to be determined by experiment."

I have made this reference to diseased meat, since it is intimately related in its bearings to the question of the power of milk to transmit the germs of disease, as tuberculosis.

From Koch's first experiments, and from those of numerous investigators since, it seems to have been proven beyond doubt that tubercular nodules in the udder are a source by which the bacilli of tuberculosis are directly transmitted with the milk. This point seems to be settled as definitely, as that flesh with tuberculous matter in it is infectious. That this danger is a serious one, is seen from German statistics already quoted, and from other data where, as in Edinburgh, of 660 cows, 37 had tubercular mammitis. How far milk from tuberculous cows with no tuberculous nodules of the udder is tuberculous (as far as clinical examination goes), is a question of even greater importance than that of whether or not meat with no tubercles is capable of transmitting the disease.

Some recent experiments in Denmark seem to show that the danger, at this stage, of transmitting tuberculosis is not very great. The question, however, of at what stage the milk of a cow affected with progressive tuberculosis becomes dangerous, or infected with bacilli, is one of such paramount importance that it is one which we may very properly consider. The following are the most recent conclusions on the subject, based upon actual experiments:

The report of the recent Paris congress on tuberculosis does not seem to have added any special light on the subject; but the experiments carried on by Dr. Ernst, of Harvard university, seem to have been so extended and thorough as

to leave no doubt as to the dangers from this source. The report states that veterinarians give instances of the infection of calves from tuberculous mothers; and that this is true is undoubtedly shown from M. Vignal's experiments, as related at the Paris congress, from which the conclusion is drawn that it is transmitted from mother to fœtus during pregnancy only in extremely rare cases.

In Dr. Stone's experiments, conducted under Dr. Ernst, 126 separate microscopic examinations of milk from affected cows were made, and in sixteen instances the tubercle bacillus was found, or in 13 per cent of cases. The report further says:

"By inoculation of the same milk in rabbits and guinea-pigs, in seventy-four inoculations we produced six cases of tuberculosis, the inoculation being from only one to three drops of milk. This means in 8 per cent of rabbits and in over 13 per cent of guinea-pigs.

"From feeding experiments with twelve pigs, nearly 50 per cent became tuberculous, and of twenty-three calves, eight, or 23 per cent, became tuberculous."

That the milk in public supplies may be dangerous has been shown by tubercle bacilli being discovered in mixed milk in Boston, and also from Foster's experiments, who found that tubercle bacilli may exist in milk for at least ten days.

How much value can be placed upon these experiments, viewed from the practical standpoint, can not yet be determined; but it is fair to say that if an inoculation of milk is made with many forms of bacteria, they seem to find milk to be a very good culture medium. That all, however, is not known on this subject must be confessed, and that the fluid tissues of the body and their secretions exert in their normal condition certain protective influences against the invasion of disease has been established beyond doubt.

Many are doubtless familiar with the results of the remarkable experiments which have been carried on during the last three years, growing out of Metchnikoff's phagocyte theory.

From these it becomes evident that there is another element in the immunity of certain animals against certain diseases, while the same animals will succumb to other diseases. That, for instance, blood serum exerts a certain bactericidal influence is known by foreign researches, as also by those of Professor Prudden. At this point comes the difficulty of deciding what constituent of blood serum possesses the power; and hence it has come about that certain nitrogen compounds have been extracted from the serum, which, when inoculated into animals, produce immunity in certain directions. These compounds have been called tox-albumins, or defensive proteids; and the theory of their action in creating immunity has been stated by Hankin as follows.

"Immunity, whether natural or acquired, is due to the presence of substances which are formed by the tissues of the animals rather than by those of the microbe, and which have the power of destroying either the microbe against which immunity is possessed, or the products on which their pathogenic action depends."

The important influence of these recent studies on our views with regard to the transmissibility of bacterial diseases cannot be overlooked, and doubtless are of much value; but there are two conditions, which, in connection with our present subject, must necessarily exert a potent influence on the normal quality of cows' milk.

The first of these is the healthy condition of the cow at the time of milking, and the second is the preservation of milk in a condition as nearly akin to its normal condition as possible. Without argument, it may be assumed that cows' milk cannot be normally secreted from tissues that are not in a normal condition. Experience has further shown that by injections into the blood, of chloroform, atropine, etc., alterations take place in the blood by which immunity is removed. For instance, Klein produced anthrax in rats after having administered chloroform, it acting as a depressant. Some of these blood changes are readily observable, and, as would be expected, such changes show themselves by alterations in

milk — a normal secretion of the tissues. Take the disease of tuberculosis in cattle; after both feeding and inoculation experiments, it is seen that a daily rise of temperature in rabbits, pigs, calves, etc., takes place of 3 or 4 degrees F. Similarly, although no tubercles of the udder may be present, a daily rise of temperature tends to take place. This has been known in advanced cases to produce a stringy condition of milk and precipitate on standing.

Now these facts may be taken advantage of in a practical way in our efforts to determine what constitutes a normal milk. Thus we are brought naturally to the study of milk as a physiological product. Whether viewed simply as a constituent directly of the blood itself, obtained by osmosis, or as a secretion elaborated in the cells of the milk glands, it is found to have in a normal state certain very well defined relations existing between its various constituents. All know the normal constituents in milk to be as generally stated, fat, and solids not fat, which latter are composed of sugar, proteids, and ash. For many years chemists, and of recent years agriculturists, have been intently engaged in determining, from the commercial standpoint, the relative proportions of these, and especially of the so called butter fat. For our present purpose it suffices to know that different breeds, and different animals of different breeds, give milks which are normal, and yet whose constituents vary notably within certain very well defined limits. Knowing these facts, chemists and others have argued that there is really no such thing as a normal milk standard possible; but these have argued from a limited knowledge of the facts, or, more probably, limited opportunities for drawing general conclusions. Very recently it has been found that while the butter fat in different animals may notably vary, yet if the cow is known to be healthy, and no abstraction of fat nor addition of water has taken place, the several constituents of milk bear to one another a tolerably definite relationship. Contrary to the old idea that milk high in cream or butter fat would show a lessened amount of other constituents, it is now known that with the percentage of

butter fat high the other solids are present in a proportionately larger amount. Thus, Professor Cochrane, analyst to the Pennsylvania board of agriculture, gives the following results at 60 degrees F.:

No.	Sp. gr.	Fat.*	Total solids.	Solids not fat.
1	1,029.6	3.38	11.33	7.95
2	1,030	3.62	11.93	8.31
3	1,029.3	3.63	11.63	8.02
4	1,033	5.70	15.64	9.94
5	1,034	5.35	14.87	9.52
6	1,034	5.19	14.70	9.51
7	1,034	5.88	15.48	9.60
8	1,034	5.05	15.69	9.64
9	1,034.3	5.95	15.60	9.55
10	1,035.2	5.70	15.60	9.90

Hence, it is very properly concluded that the lactometer, or lactodensimeter, is an instrument of much value in testing a milk from the standpoint of adulteration. Thus, a milk of low specific gravity and low in solid constituents would indicate the addition of water; a milk of high specific gravity and a low percentage of fat is probably skimmed; and a milk having a low specific and yet a high percentage of fat indicates either a very good milk watered, or an unfair sample taken from the creamy portion of the milk.

From many thousand analyses made by Dr. Paul Veith, F. C. S., analyst for the Aylesbury dairy, London, England, during eight years, broad general conclusions have been drawn. During those eight years he analyzed 84,746 samples of milk, and has preserved records of great value, from which the following are some of the more important deductions: He found that the non-fatty solids are the most constant factors in milk, having the following relations to one another:

Total non-fatty solids. $\begin{cases} \frac{6}{12} \text{ . . the milk sugar,} \\ \frac{1}{12} \text{ . . mineral matter (ash),} \\ \frac{5}{12} \text{ . . the nitrogenous matter } (\frac{3}{5} \text{ of this being caseine}). \end{cases}$

* Per cent.

He likewise found that milk from cows fed with the same foods shows a remarkable constancy of specific gravity, rarely falling outside the limits of 1,030 to 1,034.

As regards quantity, he found that the morning milking stands in relation to the evening as 100 to 72, accounted for, he thinks, by the fact of the cows having before them water during the night, and no food after the evening meal. The great increase shows a difference in quality, but not of an amount to offset the difference in quantity. Thus, analyses made on eleven different days showed in one cow (a type of the others) that the amount of pounds of milk-yield averaged

14.4 pounds at morning milking,
10.2 pounds at evening milking.

Fat solids. { 3.5 per cent at morning milking,
4.1 per cent at evening milking.

Non-fatty solids. { 9.13 per cent at morning milking,
9.32 per cent at evening milking.

That these results are constant, may be seen from similar experiments made at the Agricultural college, Guelph, Ont. The following are the results of the average of one week's examination, by Prof. C. C. James, of the milk of six cows by the Babcock tester to show butter fat:

Cow.	Morning milk.	Evening milk.
No. 1	3.25 per cent.	3.96 per cent.
2	2.76 "	4.00 "
3	3.18 "	4.33 "
4	3.42 "	4.45 "
5	2.75 "	4.18 "
6	2.63 "	3.70 "

Dr. Veith further found that the quality of milk reaches its height in November, while in the spring months the poorest milk is received, with another depression in July. The returns were gathered from thirty to fifty farms, and fresh

milch cows are obtained at all seasons of the year. It would therefore appear that at these seasons the variations depend upon climatic changes, since the amount and kind of food consumed on the same farms are much the same throughout. There can be no doubt that an influence of an important nature is exerted by weather changes. Thus, a sudden fall in the barometer, and a raw easterly wind, will in twenty-four hours lessen the yield of one hundred cows by a number of gallons; and a sudden accession of severe cold will, for a day or two, notably lessen the milk-flow. Great heat in the summer similarly affects the milk-supply. But the most notable differences depend upon the kind, amount, and methods of feeding. The physiological factor, the perfect or imperfect metabolism of digested products, — in other words, the character of the soluble constituents of food entering the stomach and the digestibility of other foods, — forms the most potent factor, under ordinary conditions, in influencing the amount and quality of milk. Ensilage of any kind will give to milk its special flavor, and produce a certain quality as regards richness and permanency; so also will such foods as bran and various ground grains; and the same is the case with brewers' grains, fresh or fermented; refuse starch-products, and so on to distillery slops.

Now while there is no doubt that milch cattle become habituated to certain foods unnatural to them, yet the experience of close observers shows that milk always has a physiological normal constitution dependent upon the perfect metabolism of wholesome grains and grasses, and that other foods do produce in some degree abnormal products. All dairymen are aware of how leeks in spring-time flavor the milk, and dairymen are very well aware that so simple a thing as turning cows from permanent pasture into a clover-field will produce so notable a taste as to cause complaints of something having gone wrong in the milk.

This subject opens up a wide field for investigation, which as yet has received but little attention, even from the sanitary standpoint. From more or less general experience, the

impression exists that the milk of cows fed with refuse grains and ensilage, all including some starch or sugar more or less altered by the alcoholic or acetic ferments, has not the keeping properties of the milk of cows fed with hard grains and grasses. The diarrheal troubles in children have not infrequently been attributed to this cause. I am not aware of any extended experiments going to show that such milk contains an excess of sugar, and, as already mentioned, Dr Veith states from his many analyses that sugar maintains its average proportion of one half to the non-fatty solids of milk, and that these constituents maintain throughout a remarkable relative constancy. On many of the farms of the Aylesbury Company, brewers' grains are fed, but it may very well be that in the English climate fermentative changes are ordinarily slower than in the warm weather of this country.

This point naturally brings me to speak of the acidity of milk, and its relations to normal physiological processes. We are aware that milk is spoken of commonly as being a practically neutral secretion, giving slight reaction with both red and blue litmus — in other words, being amphioteric. In reality, however, normal milk, owing it was thought to a certain amount of carbonic acid dissolved in it, ought to be considered as acid. Dr. Wynter Blythe by experiment has shown that milk contains, in a litre of fresh warm milk, 1.83 c. c. of gases — carbon dioxide, .06 c. c. or 3.27 per cent; nitrogen, 1.42 c. c. or 77.60 per cent; oxygen, 35 c. c. or 19.13 per cent; and that standing increases its carbonic acid by a certain amount of oxygen absorbed.

It is questionable, however, whether milk does really contain when freshly milked any appreciable amount of carbonic acid, since by experiments carried on in the laboratory of the provincial board of Ontario it has been found that the acid reaction found in milk just drawn does not alter on boiling, by which process carbonic acid would be driven off if present as a free acid. It has further been found that milk, if rapidly aerated and cooled, does not increase in its acid reaction.

The following results of experiments carried on in a large

dairy near Toronto by my laboratory assistant, Mr. J. J. McKenzie, will be found of great interest in determining this point:

The standard normal solution of caustic soda (40 grammes to 1 litre of water) was prepared, and added to milk just drawn from the cows into clean sterilized flasks. The point of acidity was delicately determined by pheno-phthalein having been previously added to the milk. It will be seen that the acidity of milk may be represented as having an average of 1.1 in a series of individual milks, or in the mixed milk from a herd of one hundred cows; that is, 1.1 cubic centimetres of normal caustic soda solution was necessary to neutralize the acidity present. As these cows had been fed month after month on fresh cut hay mixed with bran and pea-meal, and on the grass for a few hours each day, it may be said that the food was the best possible for determining what is the normal physiological acidity of milk. From the fact that carbonic acid does not seem to be a factor in this acidity, but that it depends upon some acid basic salts (probably phosphates) present, it will appear that in the determination of the acidity of milk we have a method of much value in not only testing the effects of different foods on milk, but in estimating the changes which go on in milk under the influence of bacterial ferments of various kinds.

At this point I enter upon a part of our subject so interesting and yet so intricate, that I confess to having some fears as to the propriety of my attempting to deal with it; and yet, I am convinced that until the biological factor in the study of milk has been followed with the same assiduity as has the chemical, we are not likely to greatly increase our present knowledge on the subject.

Starting then with the facts just related regarding the acidity of milk, I believe it will be found that, under ordinary conditions, the determination of the acidity of any milk will serve as a measure of the degree of bacterial infection which has taken place, and of its fitness for use as a food. For instance, in the experiments which I have recently been

directing, a milk, which showed 1.1 degrees of acidity both at milking and after aerating and cooling by a method adopted at a large dairy near Toronto, was placed in quart bottles, which had been well washed in a warm soda solution and afterwards rinsed in clean water and drained and aired for some hours, and thereafter placed in a refrigerator having a temperature of 40 to 45 degrees F. These bottles were covered with a flat metal cap and allowed to stand. After five days their acidity was tested, when it was found to have remained unchanged from the normal 1.1 degrees, and the milk, to the taste, seemed in every way normal. Now from this it may fairly be concluded that while the milk must have been infected to some extent with the lactic acid ferment from contact with the sides of the milk pails, cans, and bottles, yet the treatment of the milk by aeration, and its subsequent retention at a low temperature, served to delay for the length of time stated the multiplication of the bacillus lacticus, or, indeed, of any other microbe whose multiplication produces an acid reaction.

These facts lead us to inquire whether the care exercised in drawing the milk, in cleansing cans, bottles, etc., may not so minimize the amount of bacterial infection as to make it possible for the defensive proteids, or tox-albumins, which I assume to be present in milk, to so exercise their bactericidal influence as to actually destroy the greater part of the bacilli lactici necessarily introduced.

Fokker has shown that there is in fresh milk some compound present which actually does exert this destructive influence. From an intimate knowledge and observation for several years of the working of a large dairy and of the keeping qualities of milk, I have for some time been of the opinion that what are known as the animal odors of milk exert an important influence, both directly on the wholesomeness of milk and upon its keeping qualities. It is well known that milk, taken from a healthy cow at night and placed warm in a small pail and covered, will retain flavors to a disagreeable extent, and emit an odor, often very disagreeable. It has,

hitherto, I believe, not been seriously attempted to isolate these volatile organic compounds, which by aeration and chilling are so readily caused to disappear, although Wynter Blythe in his examination of the gases of milk might naturally have been expected to recognize their presence. He, however, seems to have found only those gases of which a table of amounts has already been given. That they are highly organized nitrogenous compounds I readily believe, and that in themselves they may in some instances be noxious, I have thought possible. For instance, we are aware that nursing mothers, under extreme nervous excitement of a depressing character, may secrete milk which will cause convulsions in the child; while I have known the milk of a nervous Jersey cow, tethered during the day in a corner of a city park where she was worried by boys and dogs, to secrete a milk which almost invariably was altered between night and morning so as to be totally unfit for use. Such facts remind us of the curious "Gemeingefühl" theory of Jaeger, whereby, under pleasing mental states or the opposite, volatile odors are produced in the body; in the one case, stimulating the heart to full vigorous pulsations; and in the other, depressing notably the heart's action, and so affecting nutrition.

Whatever be the cause of the conditions to which we refer, we learn from those engaged professionally in dairying that there are many variations in the minor constituents of milk, which seem to notably affect its coagulation, etc. Thus, this albuminous substance seems to vary, notably in amount, according to the age of the milk, and doubtless according to the healthy character of the mucous membrane of the udder and teats.

After making all allowance for these minor variations in the constitution of milk as affecting its wholesomeness as a food, it must be confessed, however, that the care of the milk, in its handling from the time of taking it from the cow until it is consumed, is by far the most important element in the question of its fitness for food. Milk taken under the best ordinary care in stables is by no means as free from bacteria

as it might be; but as too commonly taken, it is absolutely laden.

The following is the result of a bacterial analysis of milk, taken by my laboratory assistant, in a large stable, where the milk is supposed to be handled with unusual care as regards cleanliness: Gelatine plate cultures were poured, one half c. c. of milk being added for each culture. After three days, maintained at the laboratory temperature of 66 – 70 degrees F., the various plates giving the following results:

ANALYSIS OF MILK (BACTERIOLOGICAL) AT DIFFERENT STAGES OF TREATMENT.

Average of two samples.

I. Direct from cow; no precautions except milk received into sterilized test tube, 15 microbes per c. c.

II. Pail in stable receiving milk from different cows; milk strained through a cloth, 720 per c. c.

III. Milk from cooling apparatus after cooling, 884 per c. c.

IV. Milk from bottles immediately after filling, 1,640 per c. c.

As regards normal milk acidity, —

Oct. 7. Six cows gave the following: .95, 1.06, 1.27, 1.12, 1.20, 1.09 — average, 1.11. Kept in all day; 1.11 c. c. of normal soda required to neutralize. Average of mixed milk of 100 cows on cooling, 1.11

Oct. 8. Cow No. 2 of above series, 1.10; No. 3 (back lamed), 1.50; No. 4, 1.00; No. 5, 1.01. Out all day pleasant days. Mixed milk, 1.10. After standing in refrigerator, for four days at 40–45 degrees F., 1.10, 1.50, 1.00, 1.00 — average, 1.11. All milk aerated, but not otherwise sterilized.

These results are remarkable, and illustrate Bitter's (of Breslau) conclusions that air contamination is the merest incident as compared with that due to the hands of milkers, strainers, and other various utensils used. It is not then difficult to understand how, with a slow process of cooling from

100 degrees F. down to air temperature, very favorable conditions have been present for the multiplication of germs.

It is curious to note how many explanations other than the bacteriological one are given for milk changes by professors of dairying. Professor Arnold illustrated in his work a peculiarity, which, during the warm weather of a particular summer, occurred in Rochester milk, by which, after the driving of milk in wagons a few miles from the country, it was found to be coagulated while showing no marked acid reaction. This is now known to be due to certain bacterial forms different from the common acid producing forms.

Speaking of the bacteria of milk, much good work has been recently done on the subject, and some very interesting results have been obtained. Of these, those carried out by H. W. Conn, Ph. D., at the Storrs experiment station, Connecticut, are of much interest. He has, as might be expected, found almost innumerable bacterial forms in milk; but there are principally three classes, distinguished by the effects of their action on the milk. These are, briefly, — (1) The bacillus *acidi lactici*, and perhaps allied forms, which change the sugar into lactic acid and carbonic acid, and coagulate caseine into a hard mass, are aerobic, and do not liquify gelatine. (2) The second class curdle the milk without rendering it acid. These forms liquify gelatine, produce spores, and are anaerobic largely. The curd formed by these is soft and jelly-like. (3) A third class, as *oidium lactici*, seem to be common in milk, and yet produce no marked coagulative effects or acid reactions.

That, however, the various decomposition changes which occur in milk, cheese, etc., are due to bacterial action, may be realized from the fact that milks kept under various conditions have shown bacteria ranging in numbers from 300 to 6,000,000 per c. c. How they may multiply is seen by the single illustration that milk which had been kept for several days in a cool place and then showed 10,000 bacteria per c. c. was afterwards allowed to stand in a warm room some six hours, and during this time the bacteria increased from 10,000 to 1,000,000 per c. c.

Now I have intimated enough to fully set forth the fact that milk sterile on milking becomes at once contaminated under ordinary circumstances; but that the rapid development of sourness really depends upon the subsequent conditions.

Fokker, of Groningen (Holland), has given figures showing that for a short time milk seems to resist bacterial growth. For instance, he added a measure of bacterial broth to milk, and found that—

1 c. c. of milk then contained 120 bacteria;
1 c. c. of milk contained after 24 hours 10 bacteria;
1 c. c. " " " 48 " 2,200 bacteria;
1 c. c. " " " 72 " innumerable bacteria.

He further indicated, what Duclaux and others had pointed out, that the resisting power of milk is lessened by sterilization, since, if subsequently inoculated, he found it invariably coagulated in twenty-four hours.

But aside from all these special conditions there stand out the broad facts, within common experience, that good milk taken carefully does form, under ordinary conditions, an admirable culture medium for various bacteria, but especially for the common sour milk *bacillus lacticus*. I give but one of our experiments: Four sterilized tubes were filled with milk and plugged with wool; two lots being directly from the teats of the cows after careful washing, and two from the mixed milk after aeration and cooling. All were exposed to the laboratory temperature, and at the end of thirty hours all were coagulated, and showed practically the same degree of acidity measured by the normal alkaline solution.

From the results of the plate cultures already given, we have seen that the milk at these two stages showed a very notable difference in the number of bacteria present; yet in practice this amounted to very little, so long as any inoculation at all had taken place and the temperature was favorable for rapid bacterial growth. On the other hand, as might be supposed, there are degrees of purity as regards bacterial contamination; and a milk, if carefully taken, is much more likely to remain sweet if kept cool than if much contaminated.

Bitter has found that milk in sterilized and unsterilized cans varies greatly in keeping properties after Pasteurization. Thus:

Sterilized cans.	Unsterilized cans.	Temperature.
46 hours.	24 hours.	23 degrees C.
96 "	48 "	15 "
72 "	24 "	23 "
130 "	65 "	14 "
86 "	48 "	19 "
104 "	66 "	14 "

But that temperature is the main factor, has similarly been shown by Bitter in his experiments with Pasteurized milk. Thus when heated to 68 degrees C. and thereafter chilled, the following results were obtained:

At 30° C. milk remained good 6–8 hrs. longer than un-Pasteurized milk.
" 25° " " " 10′ " " " "
" 23° " " " 20′ " " " "
" 14°-16° " " " 50′-70′ " " " "

Bitter has determined after numerous experiments to make an arbitrary standard of goodness of milk by counting the number of bacteria in the sample. Milk, according to this scale, is good if the number of bacteria falls under 50,000 per c. c. Above this it becomes doubtfully good, and when 2,000,000 per c. c. are present it is absolutely destroyed. He concludes that, with regard to the preservation of milk, Pasteurization at 68 to 75 degrees C. is safe at ordinary temperatures; that in hot summer weather it will keep at least thirty hours longer; and that at this temperature the taste and flavor are not altered and cream production is not affected.

Manifestly, however, with ordinary methods, as we find them, in the care of milk, temperature, of all factors, has the most important bearing on the keeping of milk. I cannot do better than conclude these studies with a quotation from a recent critique, by M. Duclaux, "Sur la stérilisation du lait." He says:

"It seems to me that in place of always marching forward in this direction, it would be useful to retrace our steps, and ask ourselves if it would not serve better if we should avoid all necessity for heating, in preventing absolutely the introduction of all hurtful germs into the milk. In the conference, held on the 7th of June, 1889, in the Trocadéro, during the Universal Exposition, I said, 'that milk, properly taken, in a stable properly kept, by a milker who had first washed his hands and the teats of the cow, would not coagulate more quickly than milk taken without care, and having carbonate of soda added to it to mask the defects of cleanliness.' * * * 'It seems to me that in this direction lies progress, at least for milks destined for rapid consumption, and not from the side of the multiplication, or making perfect, of apparatus for Pasteurization.'"

Summing up, then, some of the practical conclusions to be derived from our studies, I would briefly formulate the following, as methods likely to conduce to an improvement in our public milk supplies.

1. After intelligent dairymen have selected their cows, it is especially desirable that a system of periodic veterinary inspection, in addition to the dairymen's inspection, be exercised, under the municipal health department, of all milch cows supplying milk to the municipality.

2. From what has already been said it is manifest that strong views should be held and taught regarding the nature and quality of the food of milch cows, whose milk is intended for public supplies. Not only has it a direct influence on the general health of the cow, but the condition of the milk at the time of taking, and also its keeping qualities, are undoubtedly in no small degree dependent on the character of the food supply. All decomposed foods, as those which are liable to undergo fermentation, should be wholly avoided. As already mentioned, the best foods are the well ripened grains and grasses, well cured and free from weeds, fed in such a manner as to supply the various milk constituents in proper amounts, and in such a way as to promote easy digestion and proper assimilation.

3. The stables of the cows are manifestly a point of great importance. Too often, dark, damp, ill-ventilated, and crowded pens have been the home of this chief of our food supplies. It is quite possible, as hundreds of dairymen and farmers have shown on this continent as on the old, to keep, even on a large scale, a dairy stable free from the ordinary disagreeable stable odors, to give the cows abundant ventilation, and to so conduct the feeding, that cows, taken from the ordinary barn-yard feeding of the farmers, will readily improve in general appearance, and increase greatly in milk and in flesh. The water supply to the cows is of equal importance. Too often, the barn-yard pool, or sewage-tainted creek, or cheese-factory drainage, are the sources from which the dairy cattle drink; and not even to mention the more delicate physiological effects of such water, cheese makers tell us that they can distinctly note the gross effects of cows drinking filthy waters by the degraded quality of the milk which, at times, comes to their factories.

4. The care of the milk at the time of, and subsequent to, taking, is, however, of all points at once the most difficult of control and the most necessary to supplying a wholesome milk. We have pointed out wherein the difficulties lie, and would only say, as Duclaux has said, "Cleanliness everywhere is the *sine qua non*." That it means almost a revolution amongst farmers and dairymen, as regards their methods, is apparent; but as Duclaux neatly says, "Producers will quickly find the means (of cleanliness and a reform in their methods) if consumers wish strongly. When people demand clean milk, they will have it. They will always have to boil milk before using, when they are not sure of the condition of the cow that furnished it; but the question will not the less have taken a great step in advance when milkmen and milkmaids know all that is implied in cleanliness." Hence, the sterilizing of the cow's teats by washing, the sterilizing of all cans and bottles by steam or dry heat, and the boiling of all cloth strainers will be necessary. Aeration and rapid cooling are of enormous influence in delaying, as we have seen,

the multiplication of bacteria, and I am convinced that the placing of milk in a refrigerator over night, at 40–45 degrees F., and allowing the cream to rise in well stoppered bottles, conduce together to the greatly increased permanency of the normal milk condition.

5. The delivery of the milk is similarly of prime importance. If placed to cool in sterilized bottles, at a low temperature, the layer of cream tends to prevent agitation in the bottles, and where the bottles are packed at the same time in accurately fitting compartment boxes, these exactly fitting into wagons specially designed for them, the agitation or disturbance of the milk in transit will be reduced to a minimum, and the introduction of oxygen is lessened. The numerous details in this regard need not be further referred to here.

6. Finally, when the milk has reached the consumer, it must be placed in a refrigerator, or promptly consumed. If in the former, I have known milk in summer weather to retain its sweetness for three or four days when precautions such as I have spoken of are present.

7. In case the Pasteurization of milk is introduced into practice by dairymen, it is necessary that the same care should be exercised in keeping milk cool, after heating to 68 or 70 degrees F., as is necessary under ordinary treatment.

In conclusion, I may say that it is my opinion, after very carefully studying the processes and results of a large dairy for four years, that, with carefully selected and inspected cows, as regards freedom from disease, notably tuberculosis, the taking of milk with care as to cleanliness in the particulars already given, to aerating the milk to remove the volatile animal gases, to bottling in sterilized and well stoppered bottles, and the placing them promptly thereafter in cold storage, at 40–45 degrees F., with careful handling in delivery, will be found to present so many practical advantages, both as regards the tastes of the consumer and the convenience of the dairyman, that sterilization in other respects will not be likely to be found necessary, or find general adoption.

WATER SUPPLY AND PUBLIC HEALTH.*

BY ALLEN HAZEN, LAWRENCE, MASS.

During the last few years, there has been accumulating an overwhelming amount of evidence that typhoid fever is often transmitted from one person to another by drinking-water. I need not refer to the experience of foreign cities, but only to mention epidemics, during the past year alone, at Albany, Wheeling, Duluth, Lowell, and Lawrence, besides many others of less extent. In a part of these cases, at least, most thorough investigations have been made, showing beyond question that the excessive death-rates were due to the pollution of the public water supplies.

Investigations have also been made, both in England and in India, showing that Asiatic cholera is most frequently conveyed by drinking-water, and we have to consider what part our water supplies might take in its propagation in the unfortunate event of its gaining a foot-hold on our shores.

It behooves us, then, to give this subject most careful consideration, with a view to understanding the exact method of transmission, and, if possible, to find measures which will secure relief.

Both typhoid fever and cholera are caused by the growth within the body of particular species of bacteria, which are most frequently taken into the system through the mouth, either with the food or drink, and it is the presence of these particular germs in a water which gives it its power of causing disease. A water may be muddy, or hard, or discolored by organic matter, it may even be sewage-polluted and

*Read at the nineteenth annual meeting of the American Public Health Association.

swarming with germs; but if it does not contain the objectionable species, its use will not cause the diseases in question.

At first sight it would appear that bacterial examination for the hurtful forms should give the true criterion of the character of a water. The difficulty of the search for pathogenic organisms, however, has greatly limited this line of work, and only confirmatory results have thus far been obtained; the bacteria have not been found until after their presence has been indirectly proved by an excessive number of cases of typhoid fever among the users of the water, which could not be ascribed to any other cause. Improved methods are being suggested for the detection of the typhoid bacillus, and it is quite probable that in the future we shall have methods at our disposal, far more satisfactory than those which we have been using.

But when we have a greatly improved method for the detection of the bacillus, how much will it help us? That the fever is due to water supply has been amply proved in numerous cases, by eliminating other possible causes, and by showing that those who drank from one water supply suffered, while their neighbors, with other water, remained free. Now when it is once established that a water supply causes typhoid fever, the number of cases among the consumers of the water is a far more satisfactory index of its condition than any laboratory tests, however perfect. In the case of proposed water supplies not yet introduced, the death-rate test cannot be applied, and we must have recourse to other methods. But supposing it were possible to show absolutely that disease germs were absent from a given river, no proof has been given that they will be absent a month hence, under somewhat changed conditions of temperature, volume of water, etc. The Merrimack river water often produces typhoid fever among those who drink it, but not always; there are times when its influence is scarcely perceptible; at other times it is capable of causing an epidemic. Aside from any analytical imperfections, the bacterial methods cannot guarantee the future of a water from its present condition, and as it is the future in

which we are mainly interested, we must look for other sources of information.

So far as we know, the germs of communicable disease are absent from unpolluted waters; they are introduced only by sewage. Waters which are absolutely free from the product of human life are, in general, safe for drinking. It is our first problem, then, to determine whether a water is sewage-polluted. This is done by inspection of the water-shed, or by chemical analysis, or by both. With surface waters, inspection of the water-shed is usually of the first importance. The sight of Lowell's sewers is better proof of the contamination of Lawrence water supply than any amount of chemical or bacterial analysis. In this case, analysis is useful in measuring the amount of pollution, and in showing any purification which may have taken place. In the case of ground waters, inspection of the water-shed is often impossible, because its exact location is unknown. In these cases, thanks to the great progress which has been made in the methods of examination, we may depend with confidence upon chemical analysis to show us the past history of a water. The analysis is especially satisfactory when the normal chlorine is accurately known. The normal nitrate is also useful in this connection. In Massachusetts, strictly unpolluted ground waters rarely have as much as 0.02 part nitrogen or nitrate per hundred thousand, and as this does not depend upon proximity to the ocean, it can be used where the normal chlorine is unknown.

If we can show that a water is absolutely free from sewage, we may safely infer the absence of pathogenic germs, although, as yet, too little is known of the diarrhea and other complaints which have been sometimes attributed to water quite free from sewage. The adaptability to public use of a sewage-free water depends mainly upon its physical characteristics—turbidity, color, odor, taste, and hardness. On these points, the public is a competent judge of what is required; the chemist makes accurate comparisons between different waters, but it is for the consumers to say what is satisfactory to them.

If we find that a water-shed is inhabited, or if the chlorine

and nitrates are above the normal, then we must conclude that the water is polluted, and other data must be obtained before we can decide upon its quality. The possibility of securing water entirely free from sewage contamination is rapidly becoming less. With increasing population, water-sheds of sufficient size are fast becoming settled, and in those portions of the country where the entire surface of the land is suited to human occupation, and especially in the neighborhood of large cities, their retention for water supply is practically impossible.

We are thus forced to face the problem of so managing an inhabited water-shed, and the water derived from it, as to secure a water supply which, although it has been polluted, is without danger to the public health.

The question now to be considered is, whether pathogenic germs could survive from the point of contamination to the point of consumption. It is not enough to show that they are not now present in the water; it must also be shown that they could not be present under any possible, or at least probable, conditions. It is our greatest problem, to determine through what conditions pathogenic germs can survive.

In its simplest form, we have the case of sewers emptying directly into a water course which is used for water supply. There has been a theory current that rivers have a power of purifying themselves, and that when the volume of sewage is not too large, in comparison with that of the water into which it flows, the great dilution and the oxidizing action of the air will soon restore the river to its original purity. Lawrence, Lowell, Albany, and other cities, knowing that their water supplies were polluted, have depended upon these agencies to purify them, and they have depended in vain. Their factors of safety were too small, — the Merrimack and the Hudson were not large enough; the distances and times were too short; the germs survived, — and increased death-rates, amounting to epidemics, were the results. The experience thus dearly obtained, with the loss of hundreds of human lives, has taught us lessons far more valuable than any laboratory exper

iments, however interesting the latter may be. We have learned that extreme dilution, even so great that the most delicate chemical tests do not with certainty show the presence of sewage; that running for a few miles in a large and well aerated river; that storage in a reservoir capable of holding one or two weeks' supply of water; and that the passage through miles of iron pipes under pressure, — that each and all of these conditions are inadequate to render a water safe.

Professor Sedgwick has shown, in his admirable report upon the sanitary condition of Lowell, that after the Merrimack water had passed through the capacious reservoir and several miles of iron pipes, requiring in all at least several days' time, the total number of bacteria was greatly reduced, and apparently, also, the number of typhoid germs, for there were relatively less cases among the users of this water than among those who drank the canal water taken more directly from the river.

It is possible that these conditions might be so extended as to secure immunity, or, at least, so to decrease the number of disease germs that their presence would be without noticeable effect upon the public health. In view of our experience, we shall do well to inquire what limits, if any, are admissible, and, in the meantime, take good care to avoid all water supplies taken without filtration from bodies of water into which sewage directly flows. Until we have positive information that the objectionable germs cannot live beyond certain limits, we can only be justified in refusing to allow any limits, and in condemning all waters so polluted.

As a solution to our problem, we may have recourse to some method of purification, either of the sewage before turning it into the water, or of the water after it has been polluted. The only processes now known, which are at once feasible and effective in the removal of bacteria, are processes of filtration. Filtration may take place either through natural soil, or through specially prepared filters. In either case it may, or it may not, be an efficient safeguard against sewage contamination. Many household filters are notoriously inad-

equate; many old wells are unmistakable carriers of disease drawn through the soil from neighboring cesspools; while, on the other hand, people drink with impunity the water from other wells, even more grossly polluted, but in soils which are more favorable to the removal of bacteria; and in some European cities a great reduction of the death-rate from typhoid fever is effected by the introduction, not of a sewage-free water, but of a well filtered, although previously polluted, water.

The sewage of the inhabitants of a drainage area may be filtered, either from cesspools connected with each house, in which case their contents slowly soak or filter through the soil toward the water courses, or the sewage may be collected and treated by intermittent filtration. In either case, great care must be taken that no trace of sewage finds a more direct channel than was intended.

Intermittent filtration is only able to exclude bacteria from the effluent under particular conditions; and these conditions must be fulfilled to insure safety. The experiments of the Massachusetts state board of health, conducted under the direction of Mr. Hiram F. Mills, have shown what many of these conditions are. I have no time, at present, to discuss these experiments; I can only refer to the published report, and say that so much light has been obtained as to make possible reliable estimates of the results to be obtained under a wide range of local conditions.

Another way of approaching the problem is, to allow the free entry of sewage into the water courses, depending upon filtration to remove the bacteria from the water before it is delivered to consumers. In the case of large inhabited watersheds, as, for instance, that of one of our large rivers, this is the only practicable way, it being impossible to maintain adequate inspection of a large area and population.

When extensive sand deposits occur along the banks of the river or lake, wells of filter galleries sunk in them have often yielded a large amount of water, so well filtered by its passage through the sand as to be quite safe. Under other local con-

ditions, similar wells have failed to yield the quantity or quality of water desired. This method of filtration is most important, but as yet no general conclusions can be safely drawn.

When there are no sand deposits to make wells and filter galleries successful, other forms of filtration have often been used.

Very prominent are the patented mechanical filters, whose essential characteristics are very high rates for filtration through small bodies of sand, often with the use of chemicals and under pressure. Such filters have been most successful in removing suspended matters from turbid river-waters, rendering them suitable for paper and other manufacturing, and also to improve the appearance of muddy, but unpolluted, waters. The success of these filters in their proper sphere is great and unquestioned. We have, as yet, however, no proof that they are capable of removing completely the bacteria from sewage-polluted waters. Until we have positive evidence that a system of filtration, under all conditions likely to occur in practice, will exclude pathogenic germs, we shall not be justified in approving its use for sewage-polluted water. The cleaning of unpolluted water is entirely another matter, not to be confounded for an instant with the present problem.

In many European cities, another and widely different system of filtration is in use. The water to be filtered is taken on to large areas of thoroughly underdrained sand, kept continually covered with water, which slowly finds its way through the sand at a rate of one, two, or even three million gallons per acre daily. The results obtained at Berlin are especially valuable, for the engineer in charge has taken into account the removal of pathogenic germs, both as shown by laboratory experiments, and by the death-rate from typhoid fever among the users of the water.

Piefke's results show that, under conditions sure to occur without most careful superintendence, bacteria pass the Berlin filters in sufficient numbers to increase the death-rate; but by giving most careful attention to details, this can be almost

entirely avoided. If the filters do not remove every single germ, the number which escape is too small perceptibly to affect the death-rate. These results, and those of other European cities, show us that continuous filtration may, or may not, be an efficient safeguard against typhoid epidemics, according to the rate of filtration, the character of the sand employed, and other details of management.

The point is established that filters can be so constructed and managed as to afford relief. We must now endeavor to find how to attain the desired result with the minimum expense; how coarse materials can be used with safety; how rapidly water can be applied to material of various degrees of fineness? Can the best results be obtained by applying the water continuously, or at intervals, with periods of rest between, during which the filter has a chance to drain, drawing air into its pores? These, and similar questions, require definite answers. Experiments now in progress at the Lawrence experiment station were designed to throw additional light upon these points. We know that fine materials and slow rates of filtration tend to give germ-free, and consequently safe, effluents.

Some limits are already known, both from the experience of European cities and from our own experiments. Some filtering materials, at certain rates of speed, give effluents practically free from bacteria. It is possible that we shall learn by further experiment that somewhat coarser materials, or that higher rates of filtration, may be employed without danger. In the meantime, when it seems necessary to take water supplies from bodies of water into which sewage directly flows, we can best secure the public health by the use of filters which are definitely within the known limits of safety.

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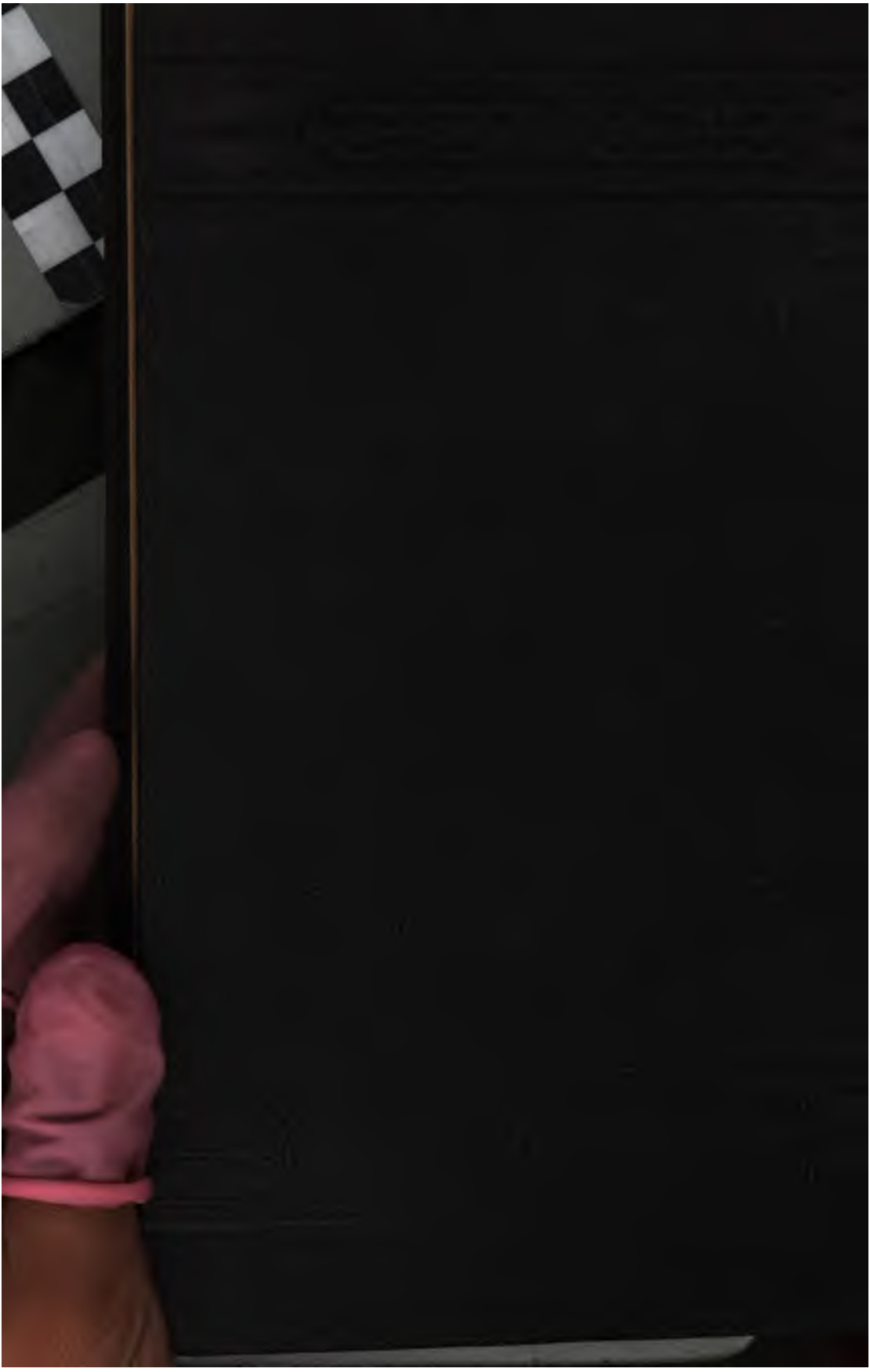
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